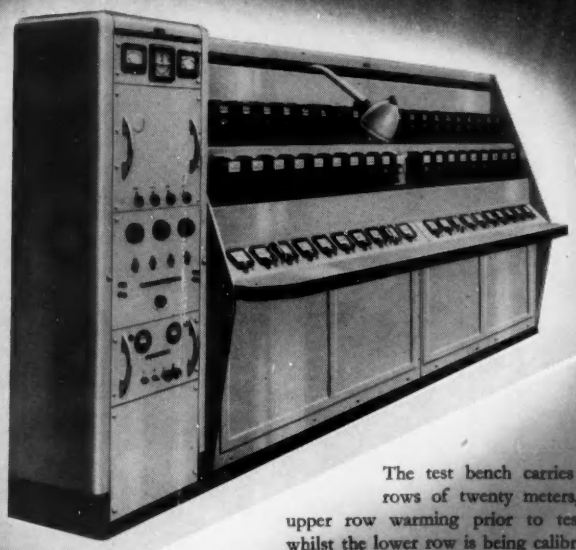
ELECTRICAL TIMES

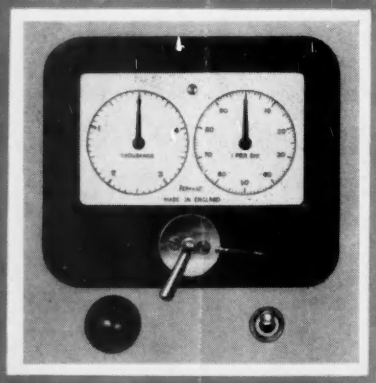


The test bench carries two rows of twenty meters, the upper row warming prior to testing, whilst the lower row is being calibrated.

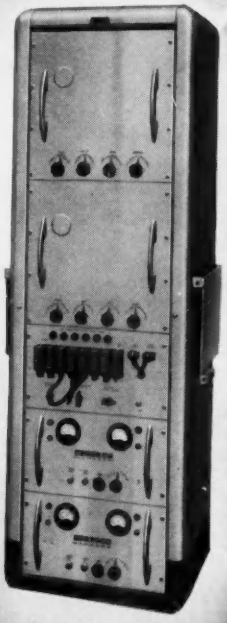
FERRANTI

HIGH SPEED TESTING EQUIPMENT

for A.C. singlephase meters.



One of the slave sub-standard counters which are mounted on a panel below the meters on test.



Conversion equipment supplied separately for modernising existing conventional test equipment

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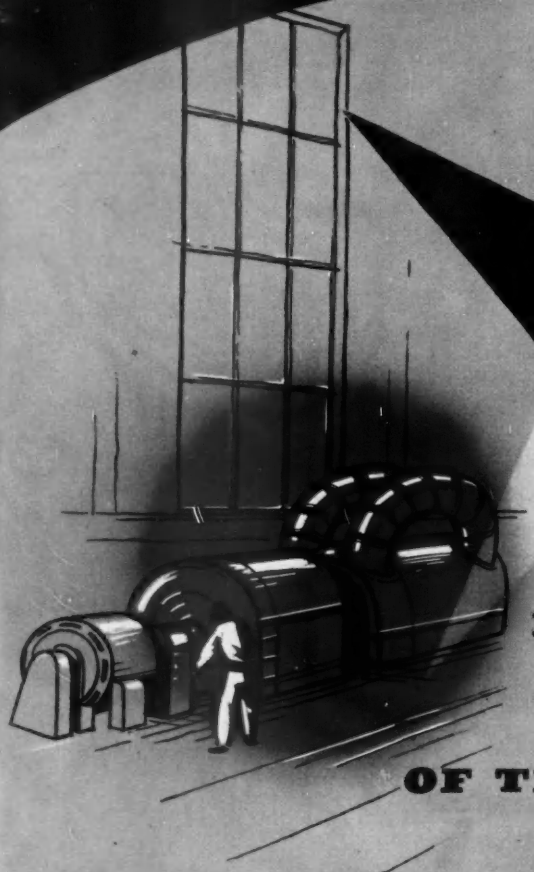
FERRANTI LTD HOLLINWOOD LANCS

London Office: KERN HOUSE, 36 KINGSWAY W.C.2

COOPERS FELT



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- *Coopers Felt serves the industry in many ways*
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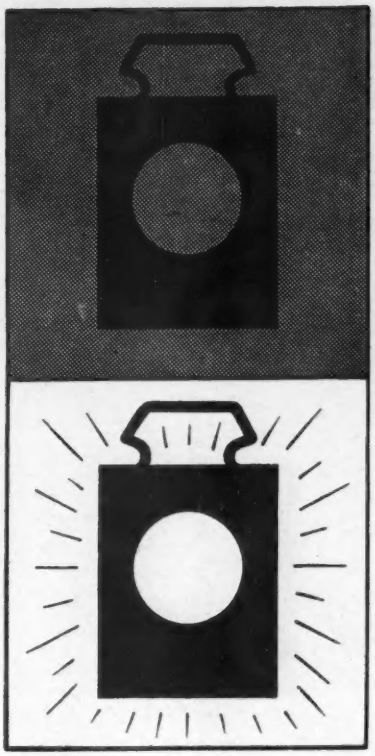
BRYNMAWR, BRECONSHIRE

Telephone: Brynmawr 312 *Telegrams: Felting, Brynmawr* *Registered Office & Works: Little King Street, Birmingham*



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Nife lamps owe their supreme reliability to the Nife steel-alkaline battery.

Nife cells never lose their charge or deteriorate when standing idle. Even after years of disuse, Nife portable lamps come brilliantly alight at the flick of the switch. Maintenance costs are negligible. There's a Nife portable lamp for every industrial purpose; for miners, firemen, railway engineers, shipowners, break-down gangs, night watchmen, public utilities, etc.

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used by the Admiralty for 30 years

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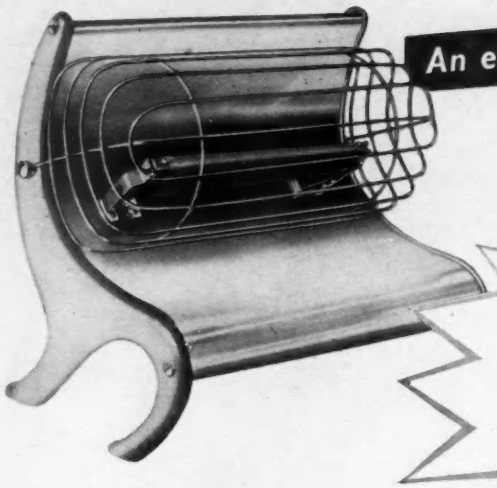
NAME.....

ADDRESS.....

.....

TYPE OF INDUSTRY.....

A



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- Safe and elegant
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PRICES		
Maximum Loading	*1 kW.*	*2 kW.*
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CARRON *Electric Fires*

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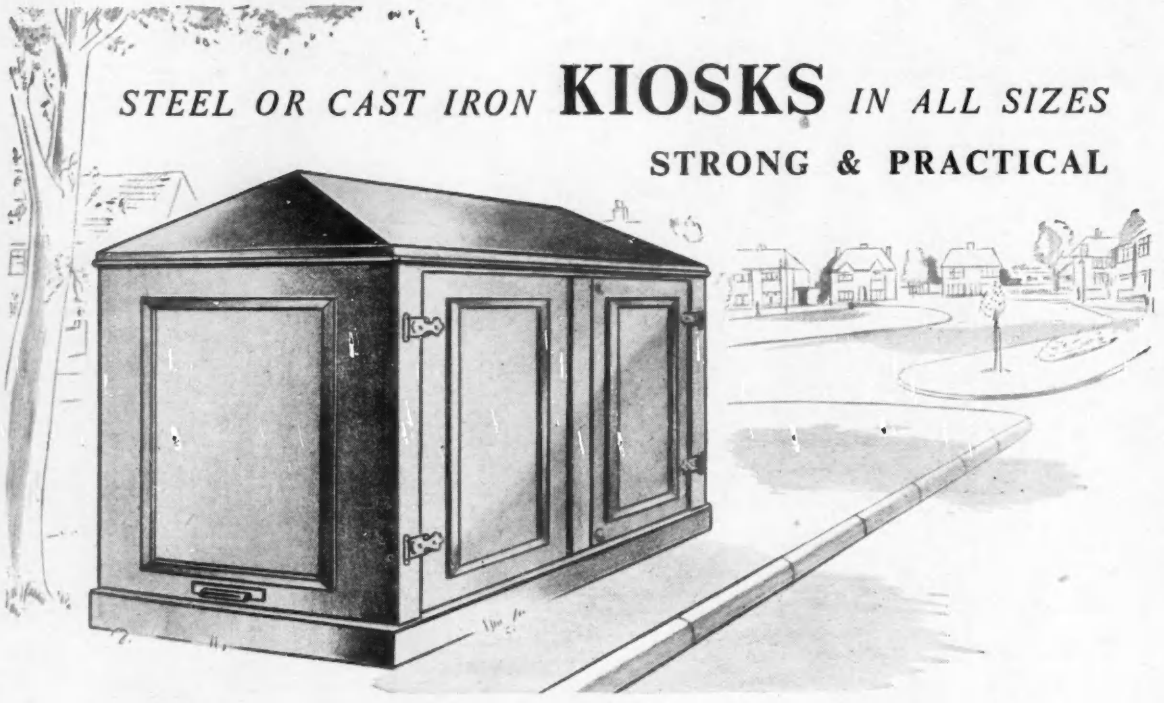

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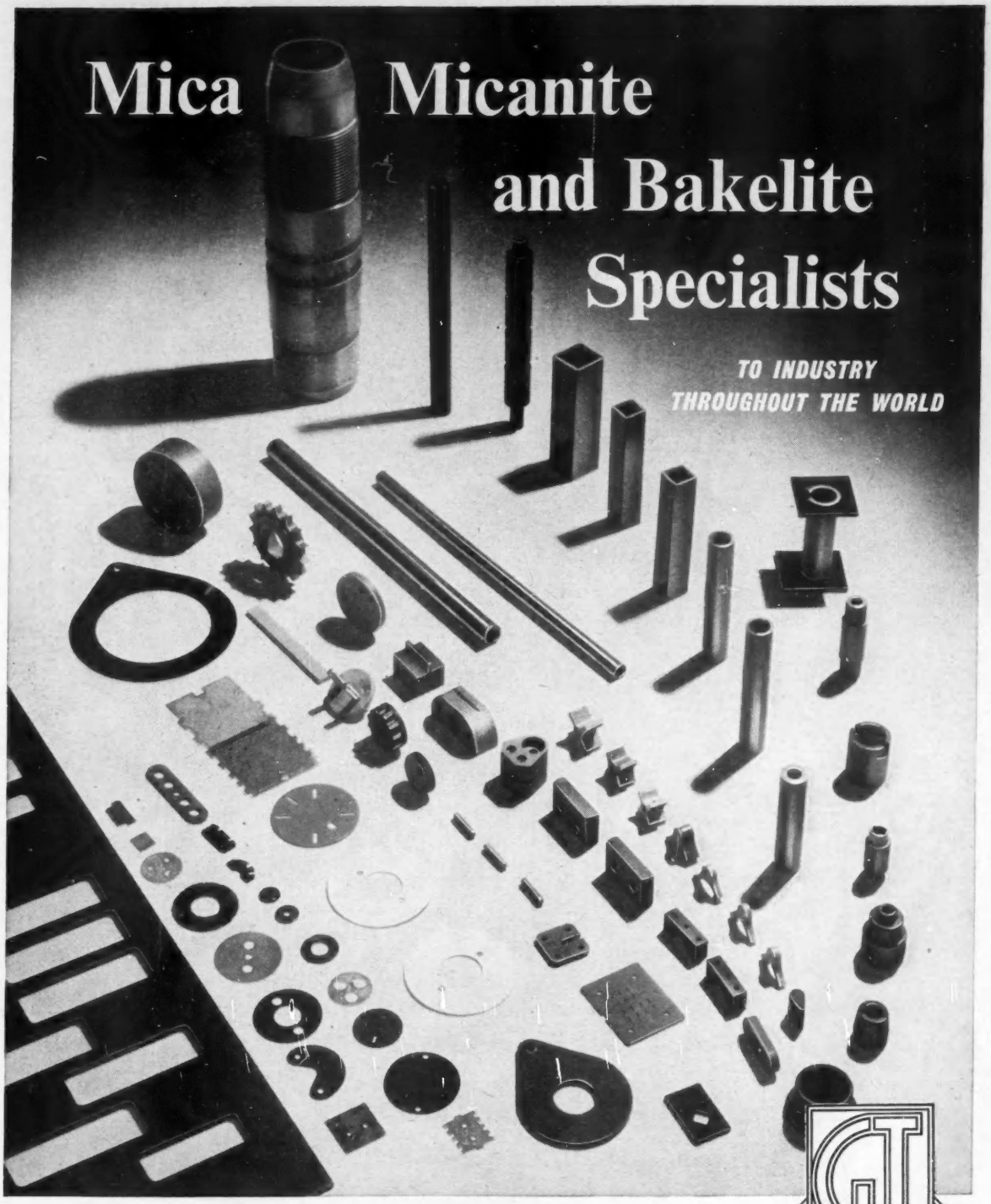

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ELECTRICAL INSULATION ENGINEERS AND MANUFACTURERS

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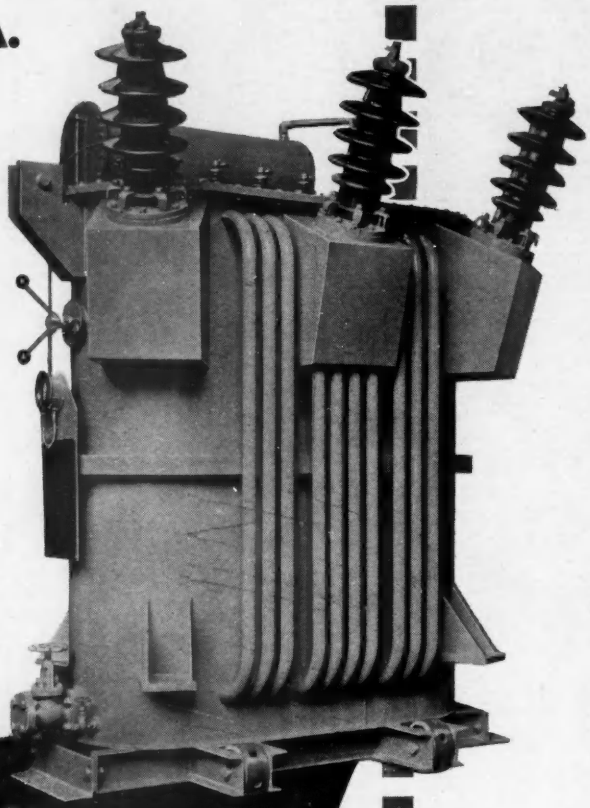
from 5 VA to 500 kVA.

We have been designing and manufacturing transformers for over 25 years.
Transformers for the rural distribution of electricity, for substations and for station auxiliaries;
for feeding electric furnaces, low voltage hand tools and lighting, electronic circuits, rectifier equipments, flash-testing etc., all form part of our day-to-day manufactures.



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products that will never let you down.

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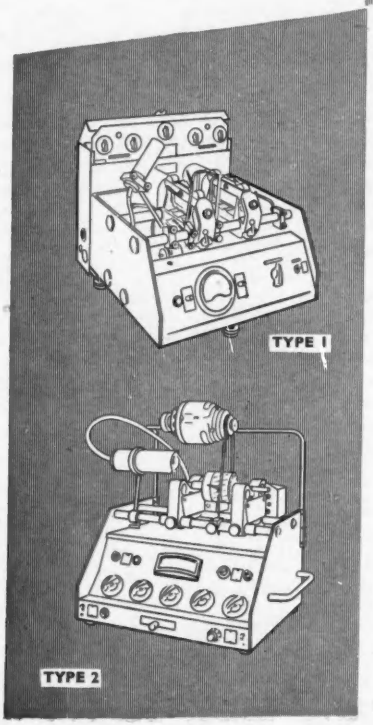
DAVENSET ELECTRICAL WORKS · LEICESTER, ENGLAND

E·M·I

Specialists in Electronic Equipment for Industry



TYPE 3B STROBOSCOPE (Above) An instrument for the measurement of speed and observation of rotary or reciprocating mechanisms. High intensity white light source. Detachable lamp. A direct reading speedmeter.

TYPE 1 BALANCING MACHINE (Top left) A bench mounting instrument of the strobodynamic type for the detection and measurement of unbalance forces in rotating bodies.

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Managements, designers and plant engineers will readily appreciate the advance of electronic aids in maintenance and manufacturing processes with its wide application in every branch of industry. Details of the complete range of E.M.I. electronic equipment which may solve your problems are available from:—

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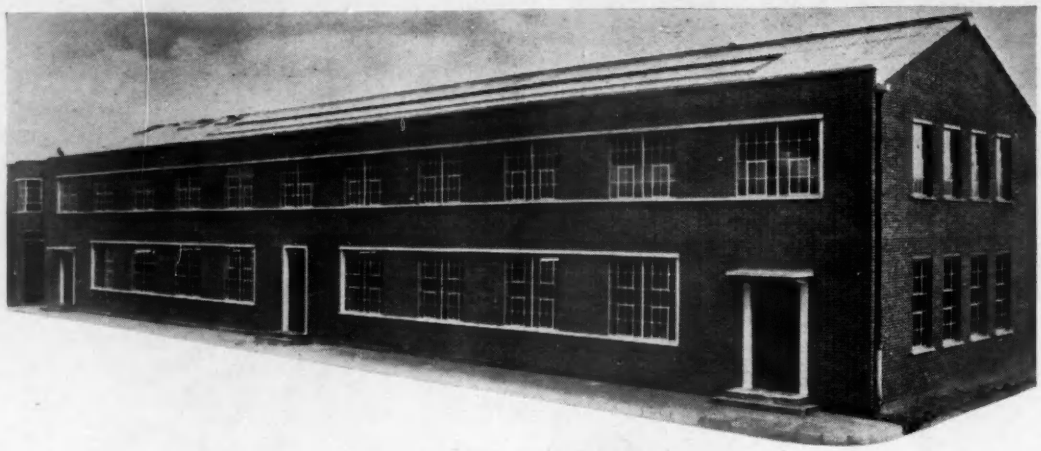


1912 — 1954

The Story of BELLING & COMPANY LTD.

No. 26 OCTOBER 1954

I generally write a couple of advertisements each year, one in October saying how we have fared during the first six months of our year and the other in April, which usually turns out to be a sort of "Annual Report". The October one is just about due, so I am trying to think of a few things to tell you.

I happen to have just written my usual half-yearly letter to all our employees and I can extract one or two points from this, which might be of general interest.

As a matter of fact, I have had to remind them that the Company took on its own shoulders the wage increase agreed with the Trade Unions in the early part of the year, and did not pass this on to the consumer by advancing list prices. As we usually pay out a share of our profits twice a year, I had to mention this point, because so far it has resulted in a lower profit margin. However, the resultant greater volume of orders, increase in trade, and public confidence have been wonderful, and our sales have leapt forward so much, that we are still able to pay out a similar bonus now to that which we paid out this time last year.

Actually our sales for the six months in question have gone up over 50% and we hope, during the rest of the year, as more and more of our factory comes into production, that we shall be able to recover our normal profit percentage. As you will remember, the sales target we set ourselves was fifty per cent above last year and I think there is little doubt we shall achieve it. Our job gets tougher every month now as, of course, we have bigger figures to compete with; however, the 20,000 ft. of extra space for production due to our moving into our new offices, pictured above, together with another 25,000 ft. which will be available about Christmas and a further 25,000 ft. in early Spring, will help us quite a lot. These latter are new buildings at the back of our Works here.

In addition, our negotiations for the purchase of another 10-acre site in the North of England are nearly complete and there we shall be duplicating the factory we have here in Enfield.

Another point I might mention is our new large catalogue. In this we have tried to introduce a little colour and also added a lot of useful general information about electricity. We have already despatched a single copy to everyone we know and I would ask you not to hesitate about writing for any further supplies you can usefully distribute. We are having 500,000 copies of this large catalogue printed together with the same number of small ones.

Re delivery: We are, of course, a bit behind as we have always been every year for the last 40 years. Anyway, we are making gigantic efforts to catch up.

Re prices: I have already dealt with these, but I would like to emphasise the fact that our popular 47AB Cooker has remained virtually unchanged in price during the past 7 years, despite the general trend in the industry to increase prices. The same applies to the bulk of our electric fires and heaters. This is surely a record.

Re new designs: As you will see we have shown one or two new fires in our catalogue. They are not at all startling, but form just a small advance in streamlining. We do find that revolutionary designs are really not much use, as the public seem to like improvements done by easy stages.

Finance: I am afraid I have nothing new to report at the moment. When we do happen to have a bit of money hanging about in the Bank, we just put up another new building and equip it with the very latest machinery but, unfortunately, it seems that every time we do this we make a bit more money and have to do the same darn thing over again. Anyway, it's all good fun and good for everybody; it enables us to keep our prices steady on the one hand and to pay out a share of our profits amongst our employees each year, on the other, so everybody is happy.

As a matter of fact, we have got into the habit of distributing about one-quarter of our profits to our employees. (This we do on a "points" basis which takes into account basic wages and years of service, and seems to work out very fairly.) I sometimes fancy putting in my own pocket the remainder of the profits, but then I think it might all get lost, so eventually it gets ploughed back again into the business, each successive year.

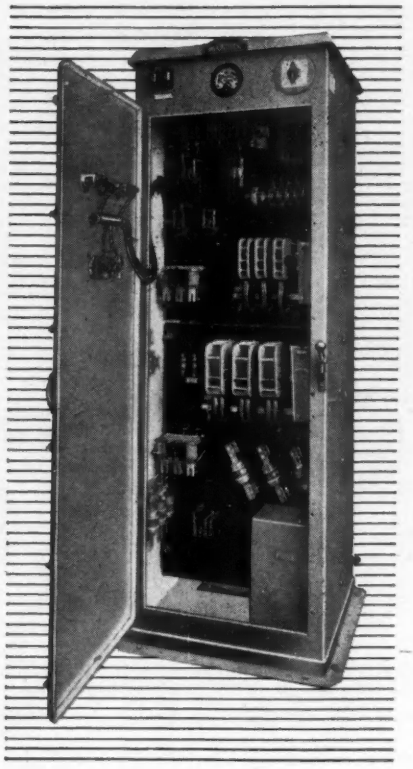
Personally, I have just saved enough to buy a small dinghy with an outboard motor for next summer. This is for use at Sandbanks where the house I have been talking about for the last three years has at last got its foundations in place (on sand!).

I am afraid this is all I have to tell you at the moment, but my next advertisement, all being well, in April 1955, will say how we have progressed over the whole year, and the results will naturally depend largely on how many orders you have been able to send us in the meantime!!

C. A. Belling

Belling & Co. Ltd., Bridge Works, Enfield, Middx. *HOWard 1212*

"But suppose standard equipment is not sufficient?"



(Above) 123/61 H.P. two-speed starting panel for induced draught fan in power station. Straight-on starting by pushbutton in each speed.

(Right) Front and rear of an A.C. single speed reversing starter for planing machine, the reversing contactors being mounted on opposite sides of the same slab.

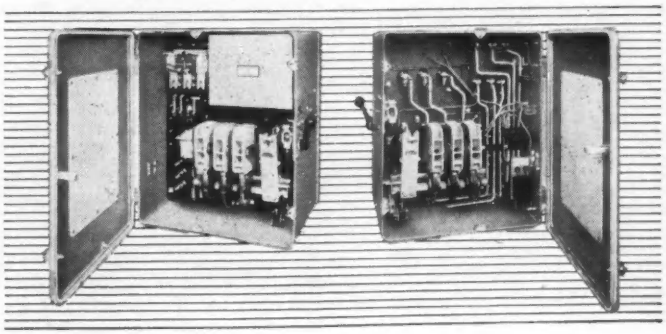
If no standard combination will suffice, Brookhirst can offer Special Design Control Gear to meet your exact requirements.

We have been manufacturing control equipment to strict and detailed specifications for a wide cross section of British and Overseas industry for over fifty years. It has become second nature to take account of conditions peculiar to one or other application whilst still embodying the highest degree of standardisation possible. All Brookhirst equipment embodies features providing against each contingency foreseen by experience yet has a minimum of elaboration. It is based on the highest precedents—in the quality of materials used, in technical performance, and in all factors governing safe, reliable operation.

The services of our Specialist Engineers are at your disposal to deal with any problem in motor control.

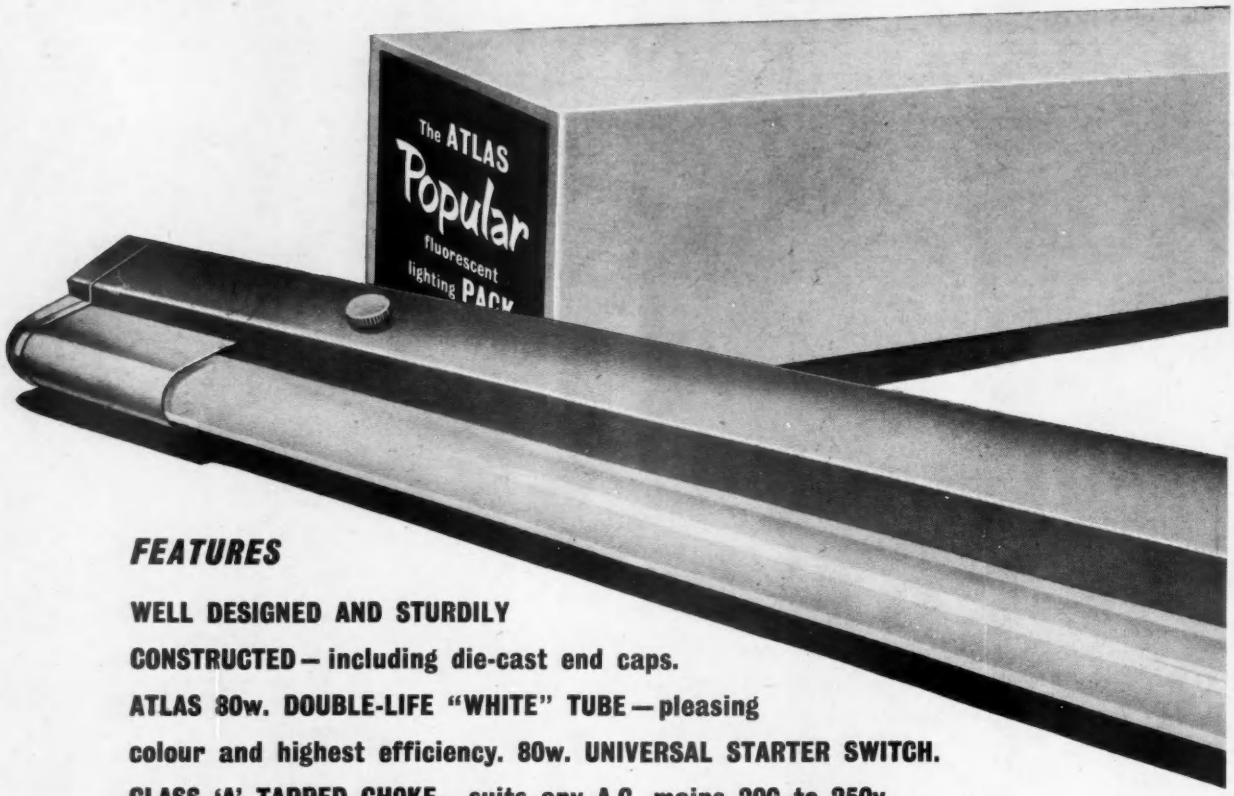
BROOKHIRST

MOTOR CONTROL GEAR



BROOKHIRST SWITCHGEAR LIMITED CHESTER

NEW! 5 FT. FLUORESCENT FITTING, TUBE & CONTROL GEAR



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WELL DESIGNED AND STURDILY CONSTRUCTED — including die-cast end caps.
ATLAS 80w. DOUBLE-LIFE "WHITE" TUBE — pleasing colour and highest efficiency. 80w. UNIVERSAL STARTER SWITCH.
CLASS 'A' TAPPED CHOKE — suits any A.C. mains 200 to 250v.
EASILY FITTED TO ANY CEILING POINT — AND SO INEXPENSIVE!

Order the ATLAS "POPULAR-PACK" through your usual supplier NOW.

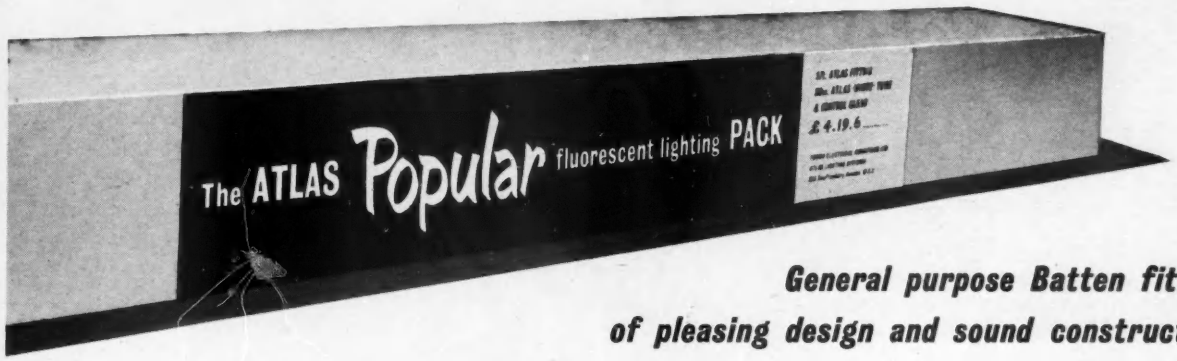
THE ATLAS Popular

Thorn

FULL SPECIFICATION ON REQUEST TO: **THORN ELECTRICAL INDUSTRIES LTD.**

£4·19·6

absolutely
COMPLETE
INCLUDING PURCHASE TAX



General purpose Batten fitting
of pleasing design and sound construction

Just what is needed to bring down costs on bread and butter contracts—a keenly-priced but well made fluorescent batten fitting, durable, reliable, complete with highest quality Atlas control gear and a 5 ft. 80w. Atlas WHITE tube. All for under £5. Wherever costs must be kept down and a batten fitting is required, put up the Atlas "Popular". Meet the growing demand for fluorescent fittings with the Atlas "Popular Pack" now. It will make sales and save you time and money.

FLUORESCENT PACK

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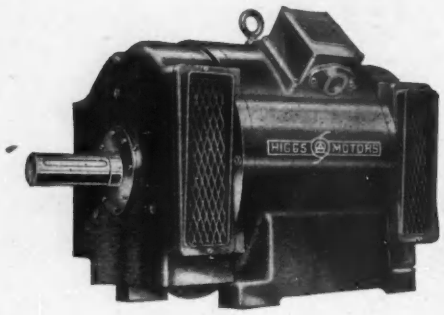
TRADE MARK

HIGGS MOTORS LTD.

CHAIRMAN WALTER F. HIGGS M.I.E.E.

BIRMINGHAM 6 ENGLAND



HIGGS INDUSTRIAL INDUCTION MOTORS
for
Heavy Duty plus Reliability

GUARANTEED FOR EVER

Belfast - Bristol - Cardiff - Dundee - Glasgow - Hull - Leeds - Liverpool
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STRONGER (U.T.S 26/32 TONS / SQ. IN.)

SINTERED STEEL COMPONENTS

economically produced in **one operation by**

MPC

- Can be CASE-HARDENED to file-hardness.
- Are made to close tolerances.
- Have excellent finish without grinding.

★ Sintered MILD STEEL parts for lighter duties are produced at even lower costs.

★ M.P.C. Sintered Powder Metal techniques eliminate costly machining operations—especially in components with complicated profiles. For parts in BRASS, BRONZE, ALLOY, IRON, GRAPHITED IRON or STEEL, this process is worth investigating.

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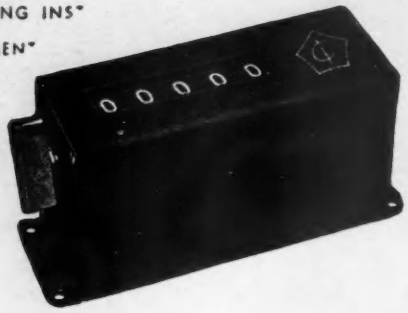


Illustrated is our Proud Mounting Electro-Magnetic Counter with five figures; details of this and other models are given in our leaflet EM.

COUNTING INSTRUMENTS LTD.
5, ELSTREE WAY, BOREHAM WOOD, HERTFORDSHIRE
Telephone: ELSTREE 1382-3-4 Cables: COUNTHOR BOREHAMWOOD

CONDUIT & FITTINGS SUPPLIED BY

METALLIC

A TI COMPANY

It may be a School, it may be a Factory—a Power Station or a Housing Estate, but more often than not the electrical specification will be—METALLIC.

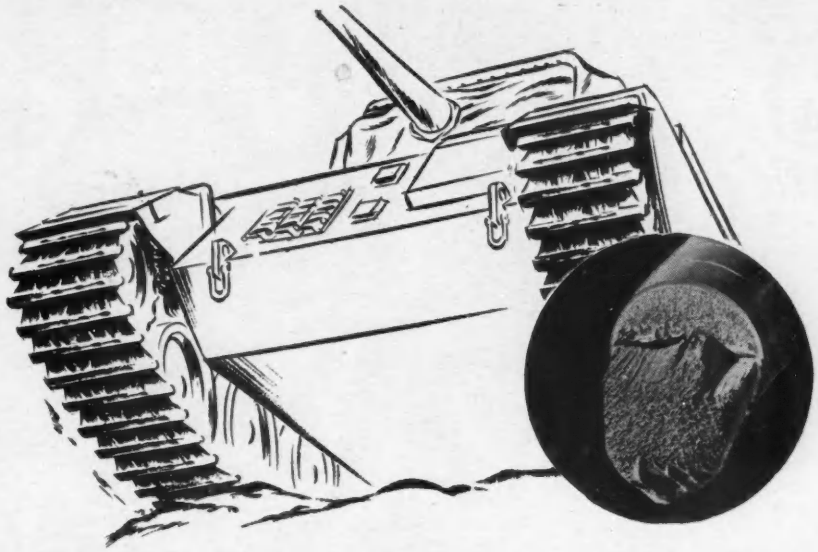
This Yorkshire Mill is no exception, being fitted throughout with METALLIC Conduit and Fittings—unequalled for quality and consistent accuracy

Oswin Mills, Frizinghall, Bradford. Photo, by courtesy of Samuel Rushworth Ltd.

Electrical Contractors for this important installation: A. R. Farrar & Co. Ltd.

THE METALLIC SEAMLESS TUBE CO. LTD.
LUDGATE HILL · BIRMINGHAM · 3

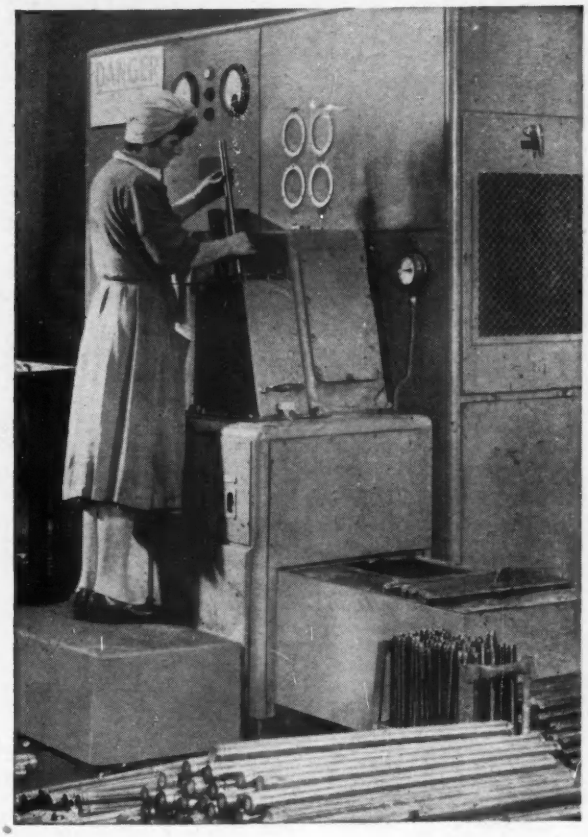
ALSO AT LONDON · NEWCASTLE-ON-TYNE · LEEDS · SWANSEA & GLASGOW



SURFACE HARDENING of tank track pins

Tank track pins are being surface hardened with a G.E.C. high frequency induction hardening machine at the Cardiff works of Curran Steels Ltd. The pins are hardened to a minimum of 54 Rockwell C and to depths varying from .025″ to .050″. Previously it was found difficult—and with one pin size impossible—to restrict the hardened surface to acceptable limits and all pins had subsequently to be straightened.

Write for details of G.E.C. high frequency heating.



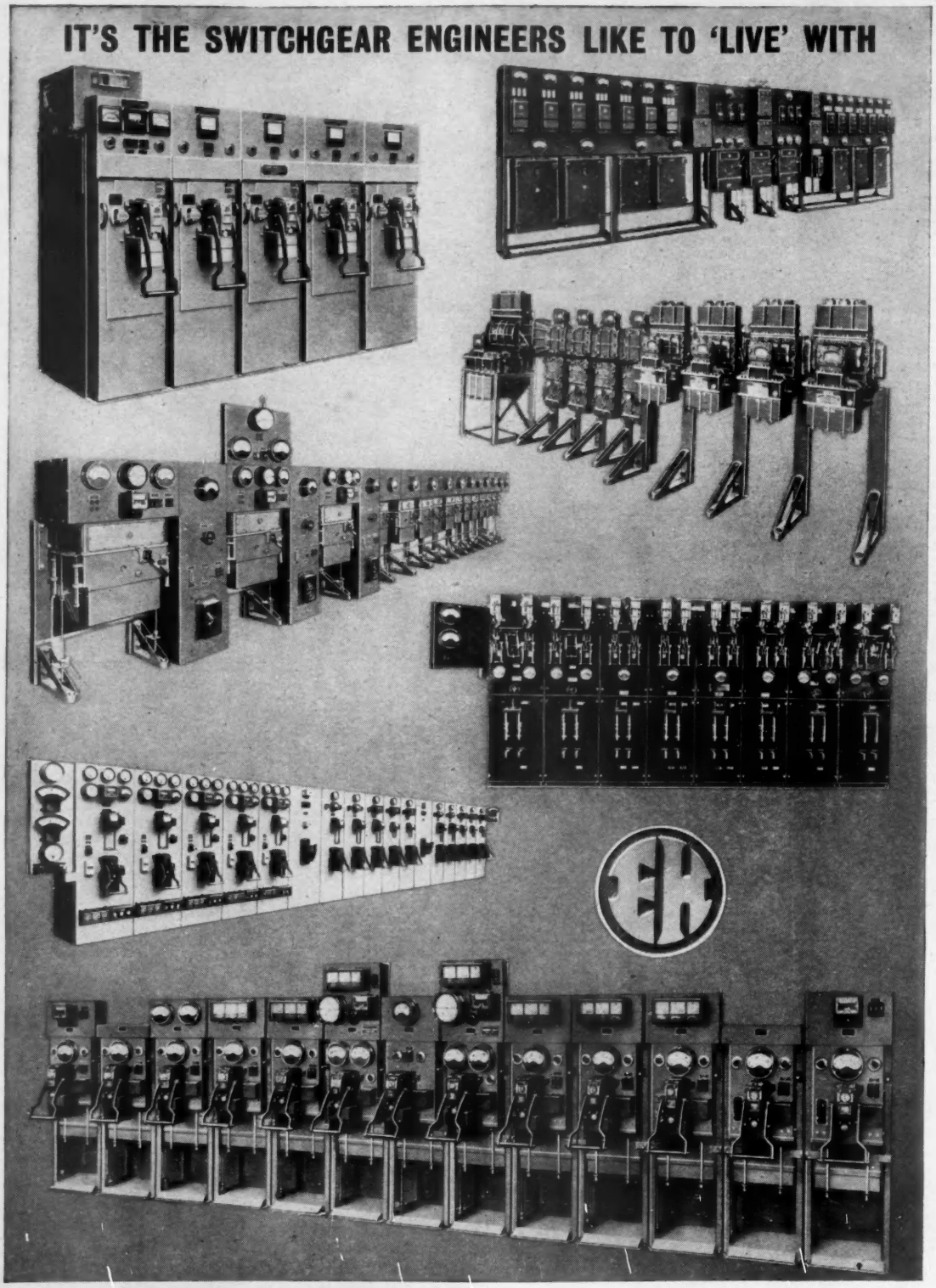
G.E.C.

PROCESS HEATING EQUIPMENT

FURNACES • HIGH FREQUENCY • INFRA-RED

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

IT'S THE SWITCHGEAR ENGINEERS LIKE TO 'LIVE' WITH



ERSKINE, HEAP & Co LTD

SWITCHGEAR SPECIALISTS

Head Office & Works BROUGHTON, MANCHESTER (7)

London Office GRAND BUILDINGS, TRAFALGAR SQ., W.C.2

BRANCH OFFICES AND AGENCIES IN ALL PARTS OF THE WORLD

L. T. SWITCHGEAR 50/5000 Amperes
E.H.T. SWITCHGEAR
up to 11 kv 250 MVA rupturing capacity
MOTOR CONTROL GEAR ¼/5000 H.P.

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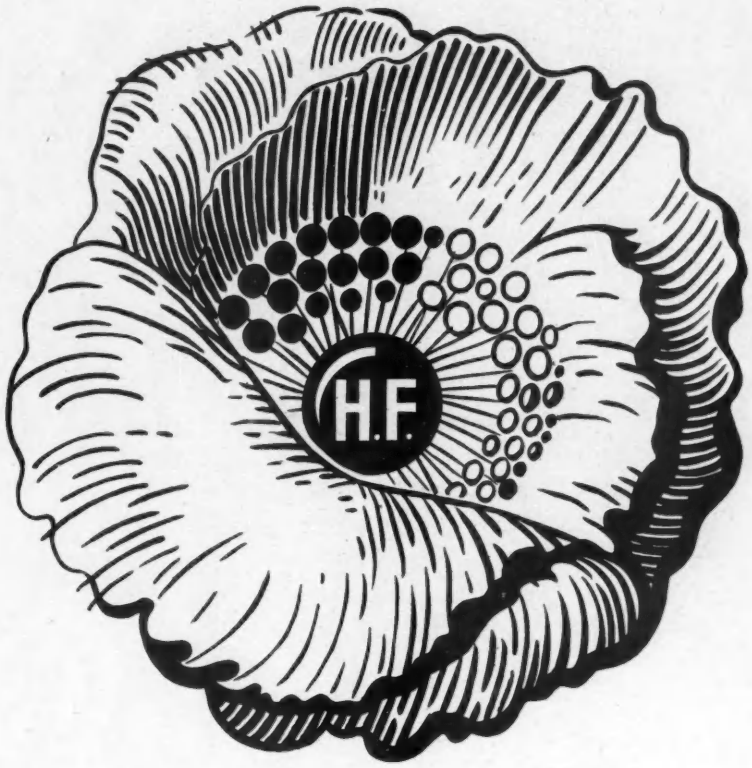
Remember



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THE INSTRUMENT MODEL

Specially designed for soldering operations in the compact assemblies used in present day radio, television and electronic industries.

Weight 3¼ oz. (excluding flexible).

Length 9 in.

25 watts — 200/220 volts or 220/240 volts.

Interesting features

(1) Bit ⅛" diameter, simple to replace.

(2) Steel cased element, also replaceable.

(3) Detachable hook for suspending iron when not in use.

(4) Moulded two part handle, remains cool in use.

(5) 6 ft. Henley 3-core Flexible.

HENLEY SOLON TRADE MARK ELECTRIC SOLDERING IRONS

W. T. HENLEY'S TELEGRAPH WORKS CO. LTD.
51-53 Hatton Garden, London, E.C.1

Wherever large quantities of hot water are required install a "Dunlow"

Electric Storage Tank

Heavy gauge copper cylinder, lagged and protected by outer steel casing, or suitable for lagging on site. Storage capacity and KW loading to meet requirements.

DUNCAN LOW LIMITED

293 Bell Street, Glasgow, C.4
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Dunlow

Amalgam RESINACT—

A supremely efficient new solder

FREE testing sample. Write to us for a sample of this new, A.I.D. approved, activated solder wire with non-corrosive RESINACT core. It is specially designed for all electrical work and is available to any specification in sizes from 4-22 W.G. We are specialists in all forms of fusible alloys.

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ESTABLISHED 1833
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Telephone: HOP 0414 Telegrams: Amalgam, Sedist, London
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Paper insulated cables up to 33kV, to BSS or special requirements.

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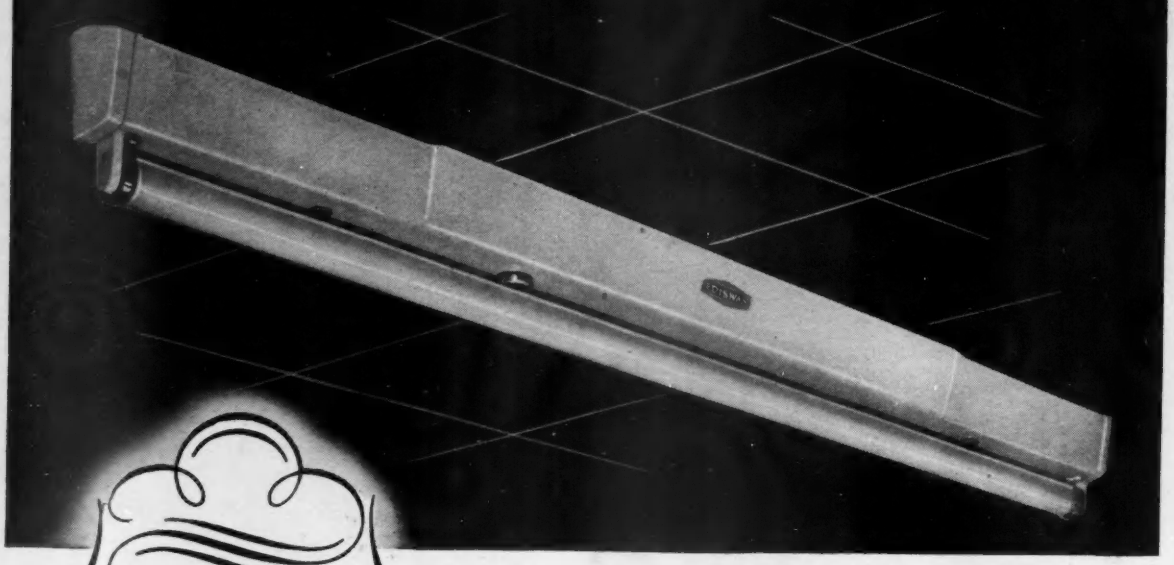
B

Installation Costs CUT-



New low-priced 40 Watt 4ft. Ediswan lighting fitting

Cat. No. LS. 4007

The unit comprises a tapered channel body fitted with die cast ends. Into the top of the channel portion is fitted a sheet metal ceiling plate carrying the control gear.

The ceiling plate and channel are united by captive screws, the heads of which project on the underside of the channel. The sheet metal is pretreated before being finished glossy white stoved enamel.

The Patent "PENDICONE" fixing method enables the unit to be installed very quickly by one man. "PENDICONE" washers (patent applied for) used in conjunction with the two-way key slots in the ceiling plate allow the two c/s ceiling screws to be inserted before the ceiling plate is fixed to ceiling.

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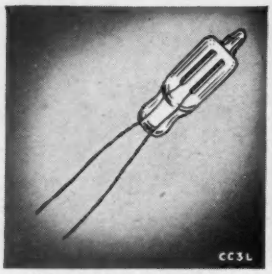

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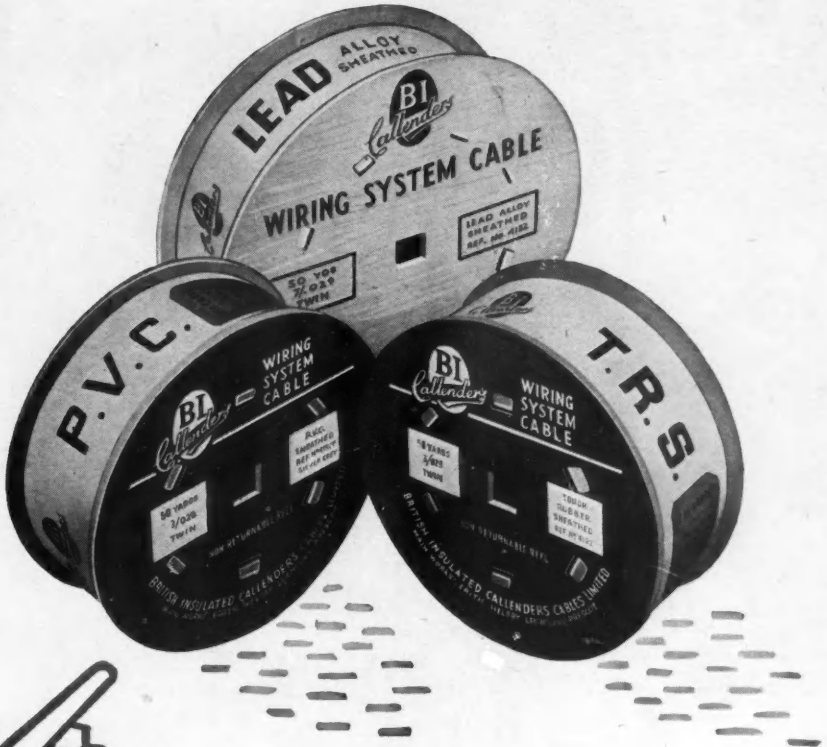

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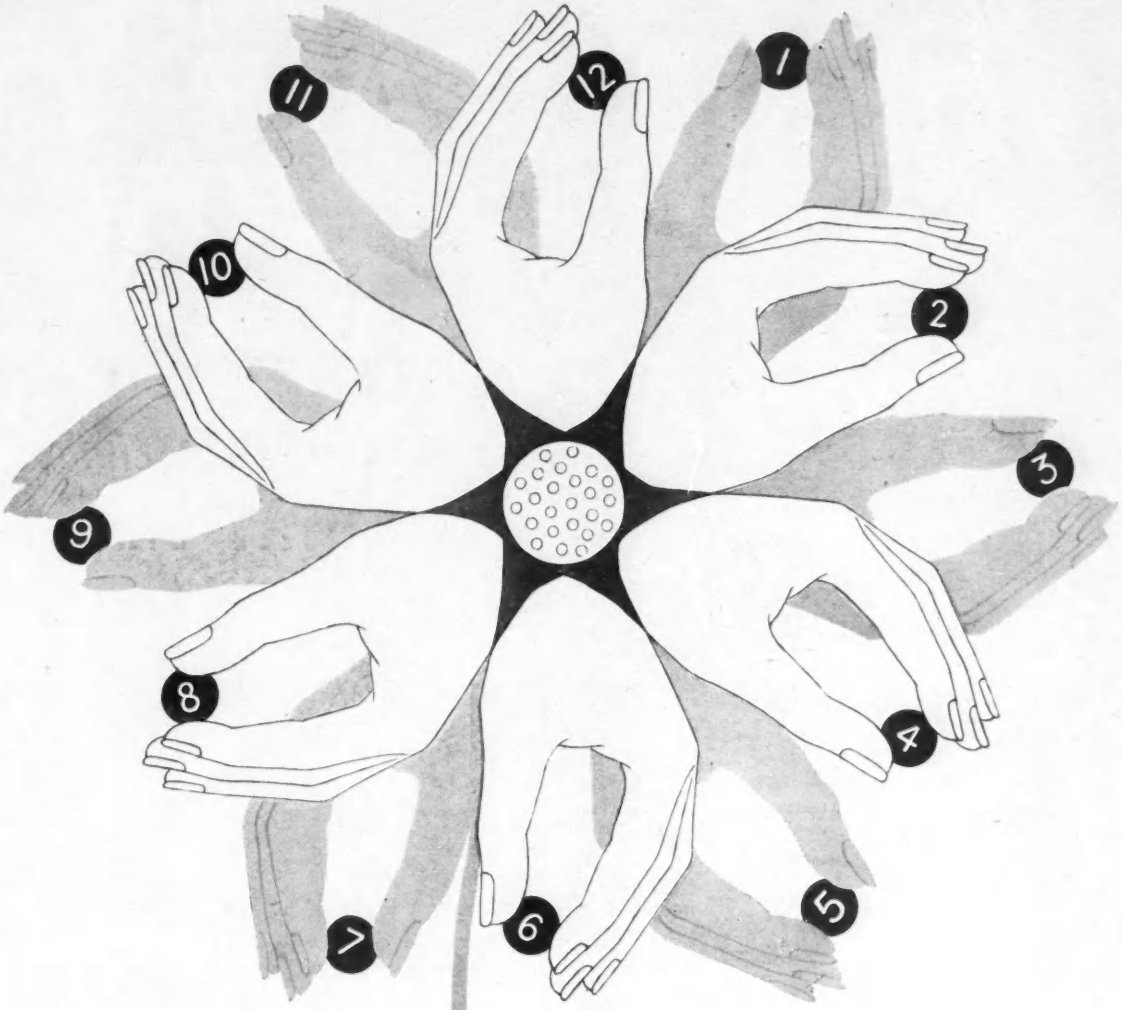

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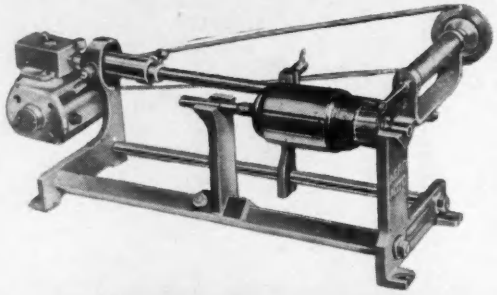

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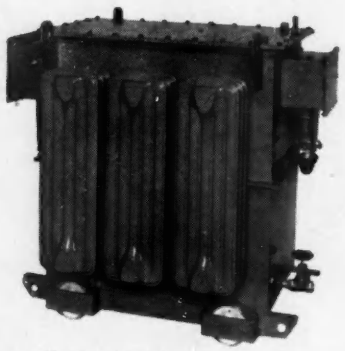

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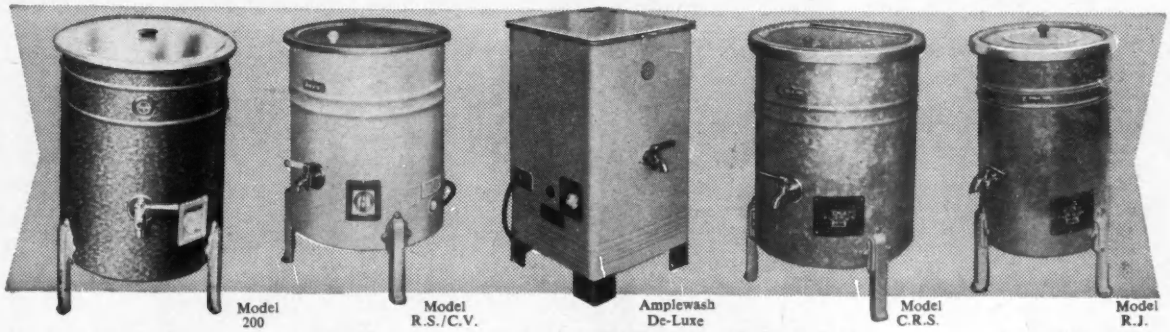

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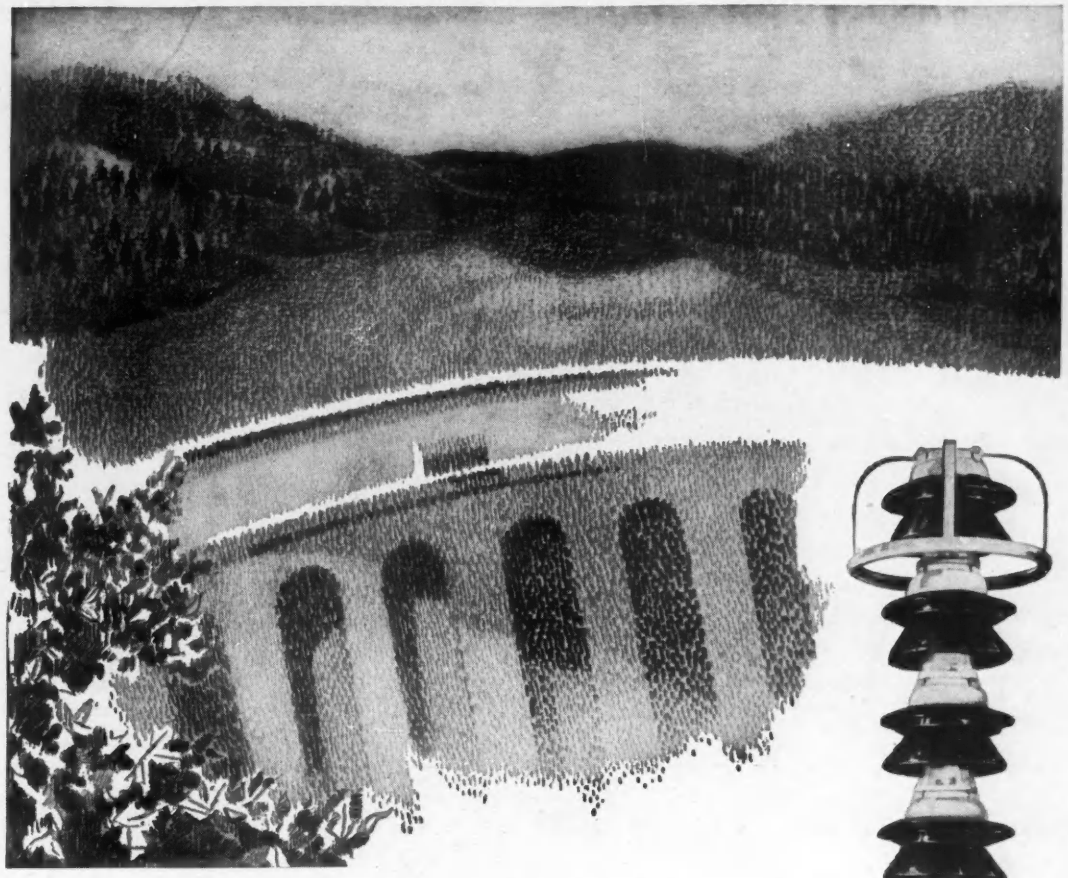

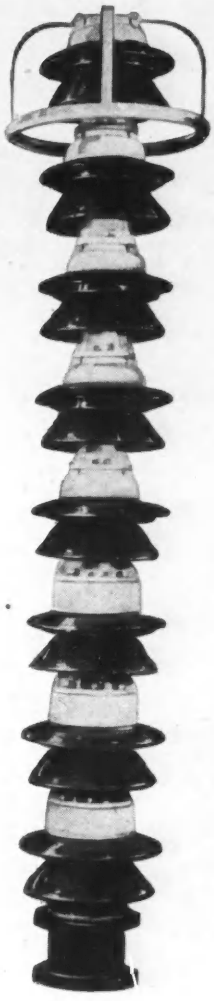

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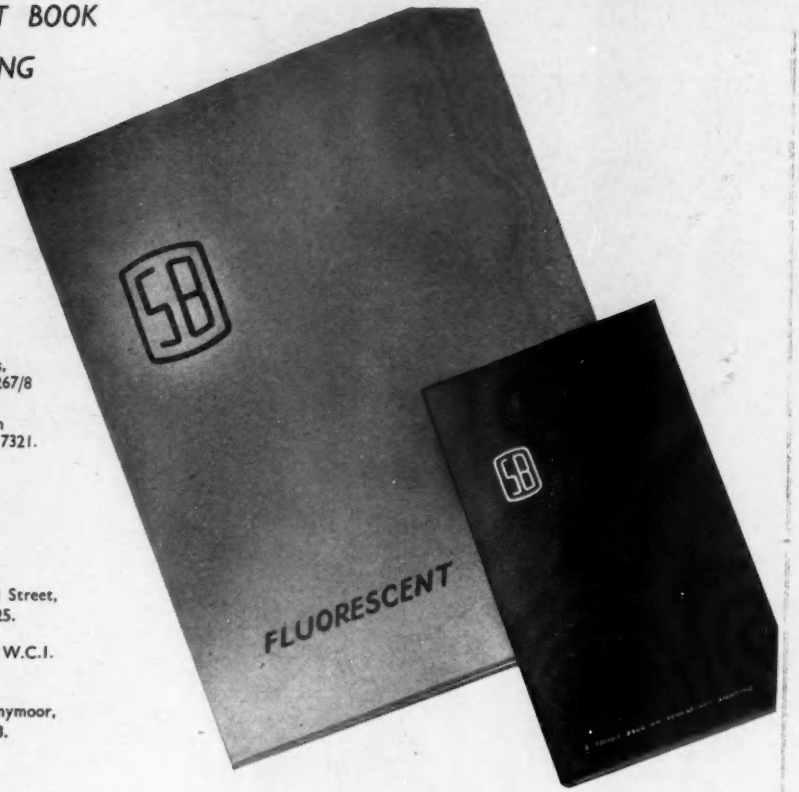

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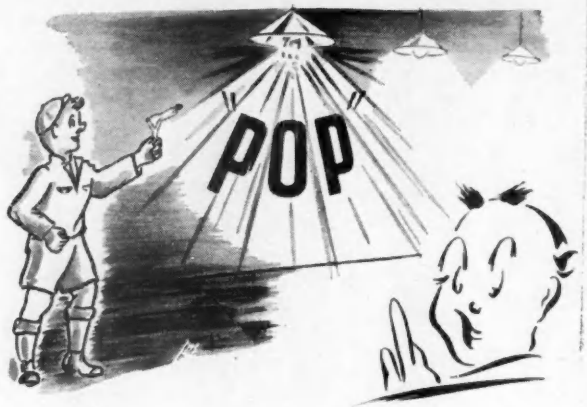

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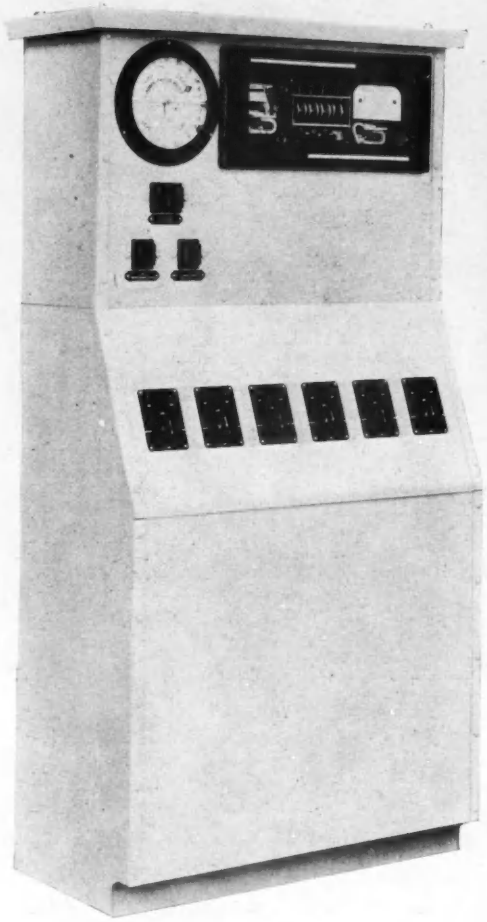

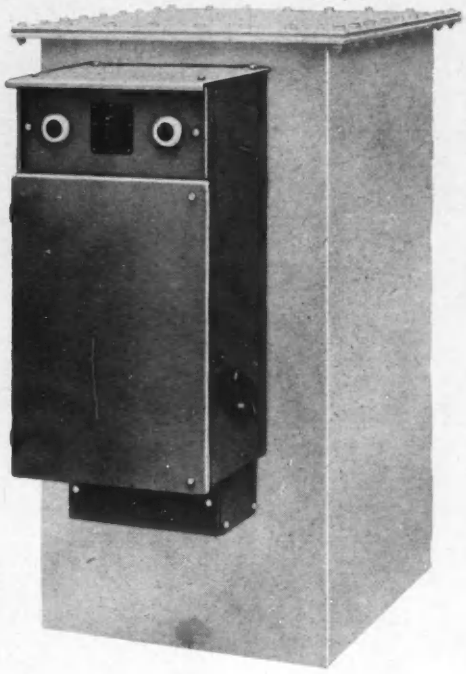

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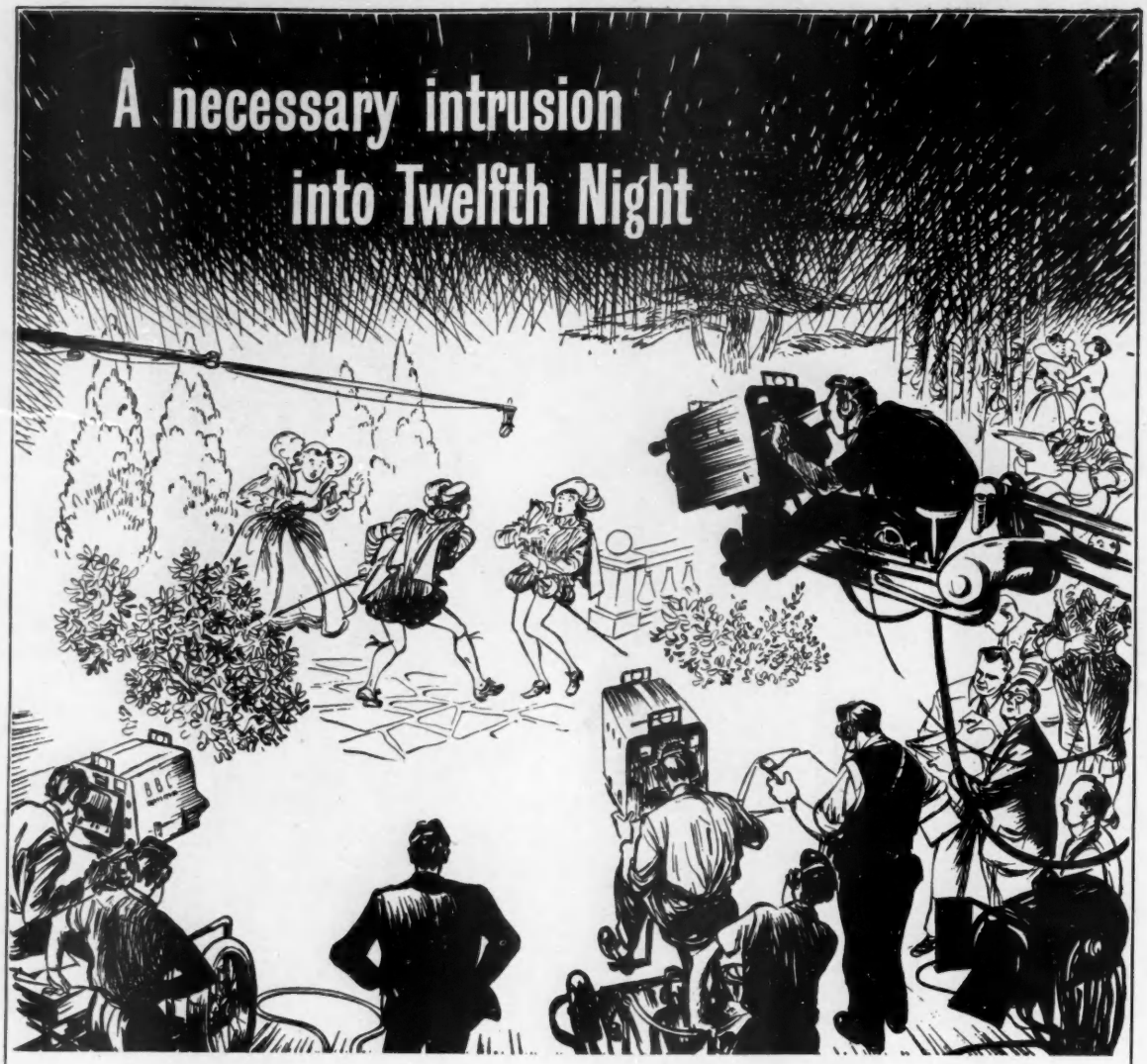

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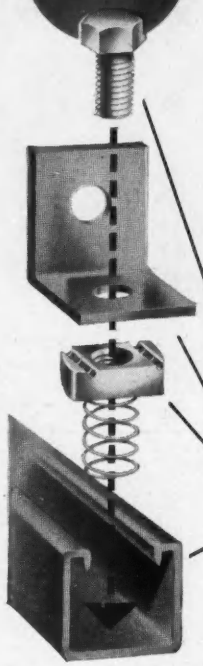

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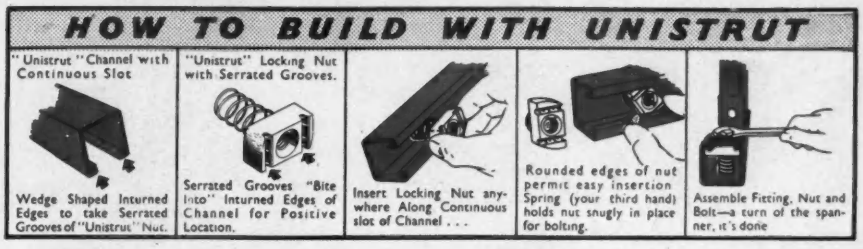
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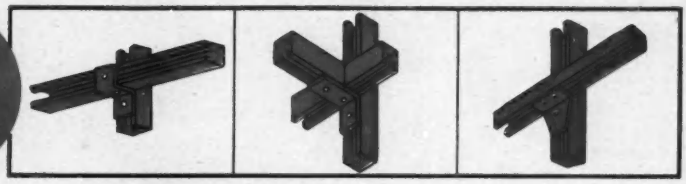

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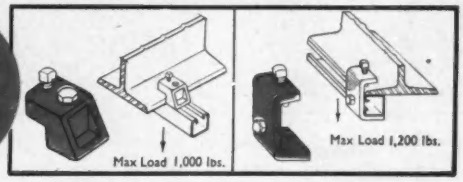

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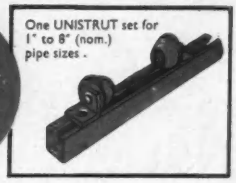

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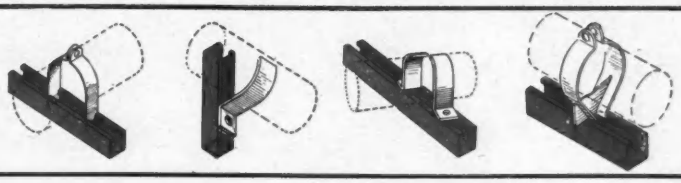

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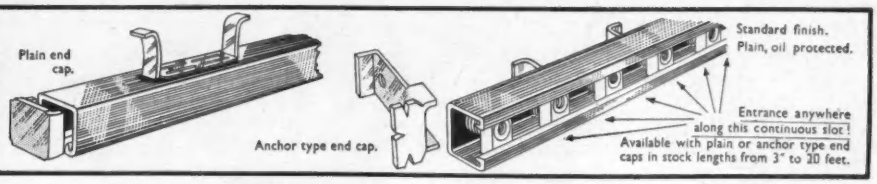
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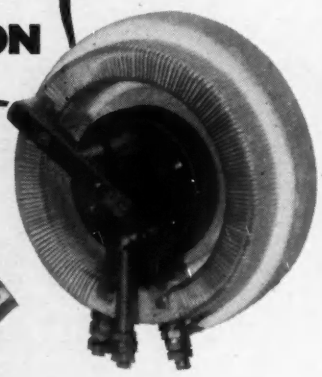

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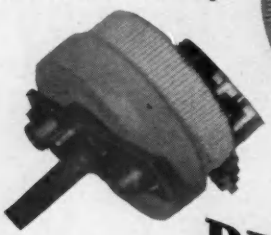

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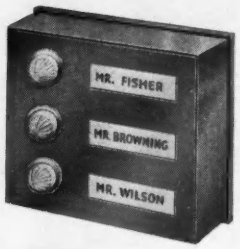

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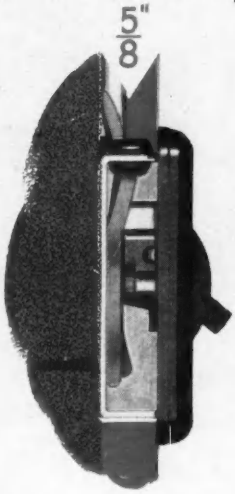
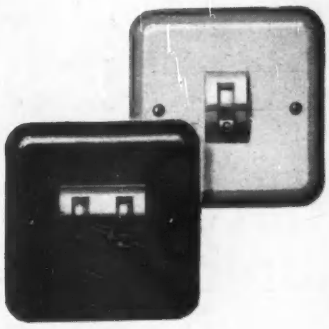


REMEMBER POPPY DAY

*See British Standard Code of Practice, CP 211, (1949).



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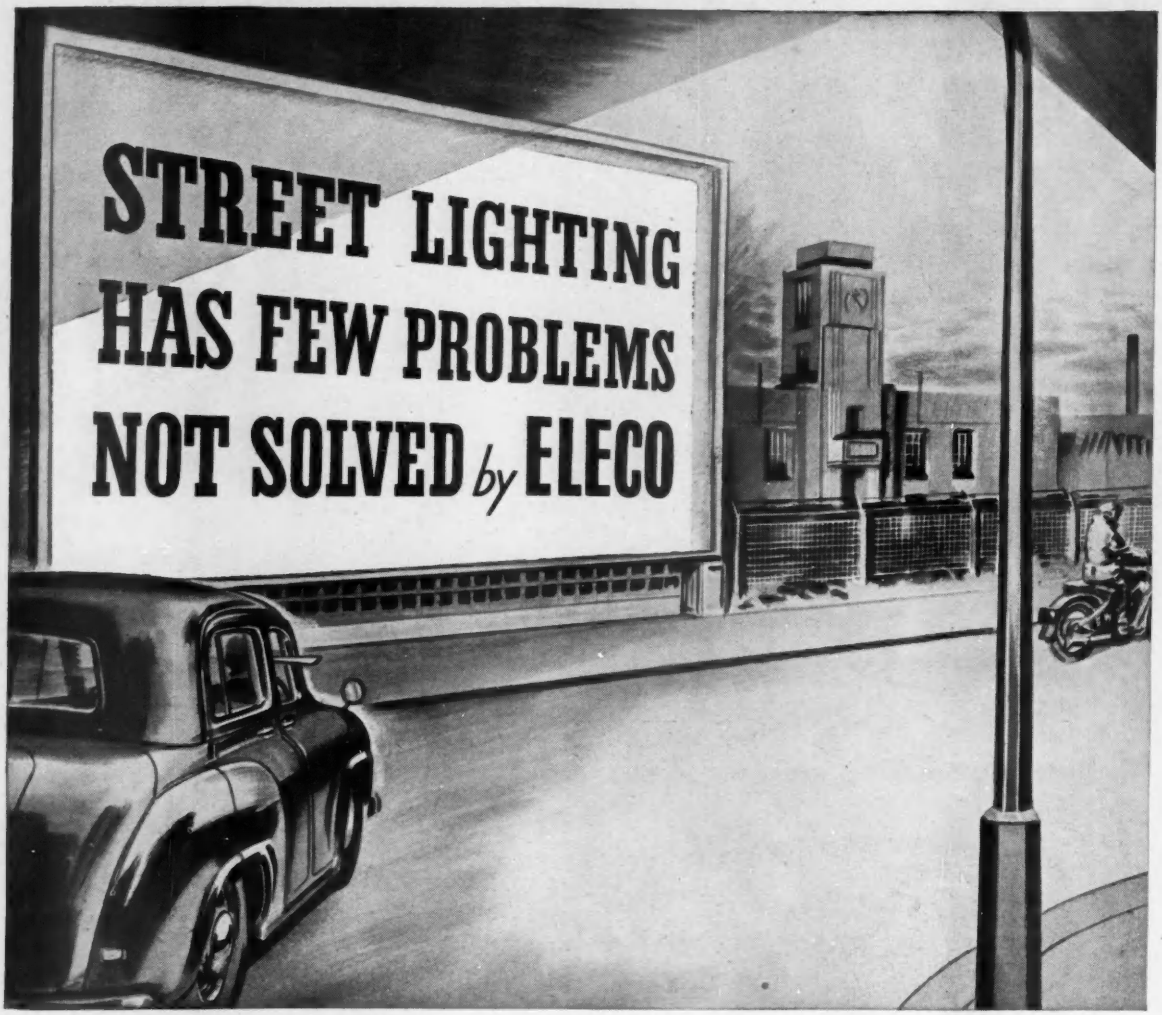

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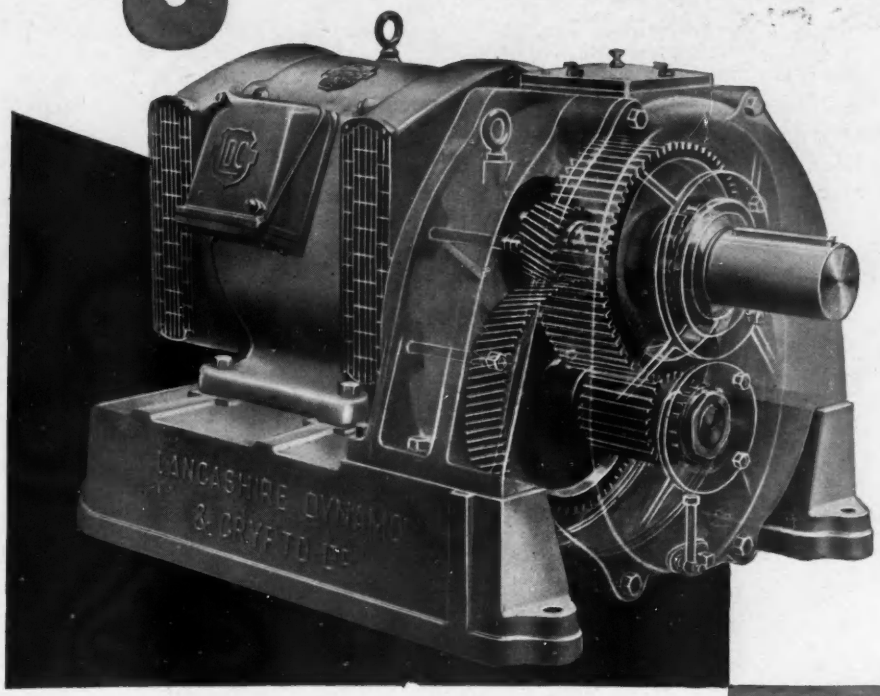

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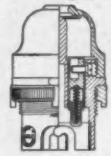

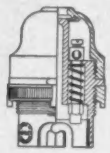

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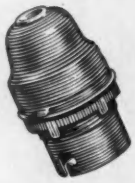
Terminals move during lamp insertion or removal.



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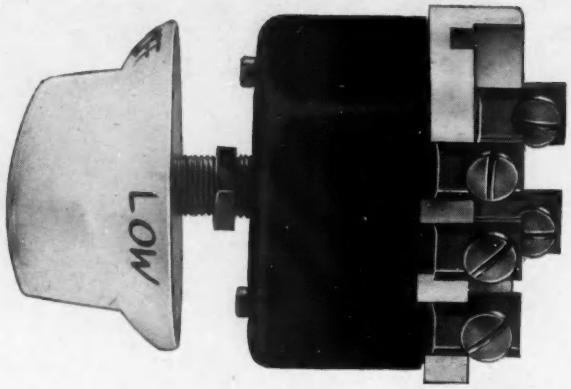

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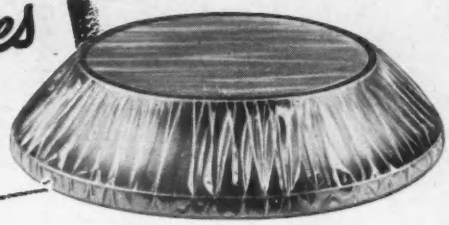

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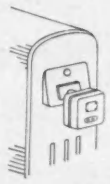
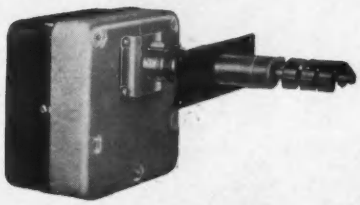
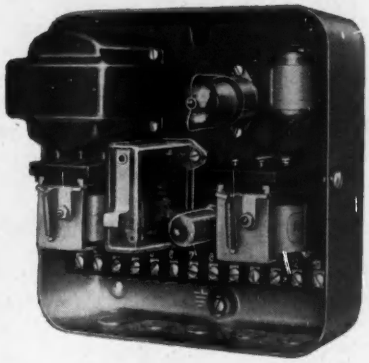
The Danfoss leaflet No. S 53B-123 will give you detailed information. Your request will ensure all future publications being mailed to you.





The type CBK with built-in flame control means simplified mounting.



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For special cases where separate flame control is specified

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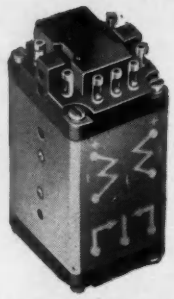

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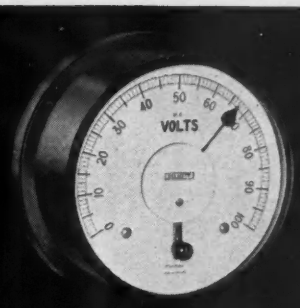

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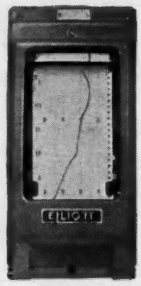

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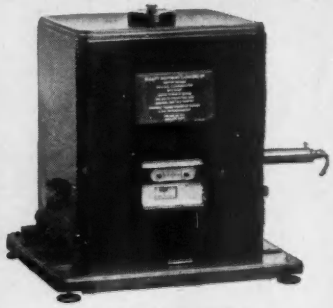

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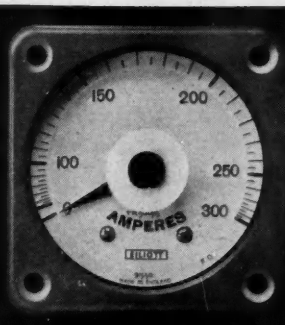

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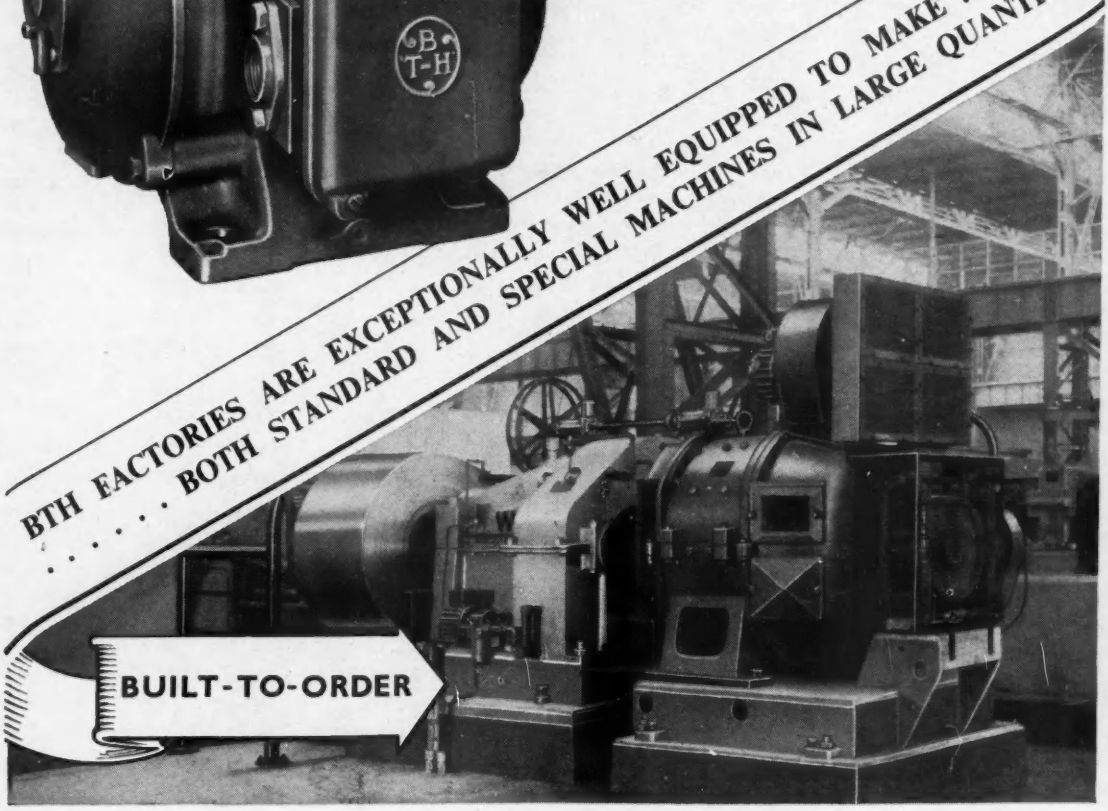

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TRADE AT THE FLOOD

The months before Christmas are always a peak period for retail trading, and the electrical industry expects to share in this fully: but this year the upsurge in demand threatens to become embarrassing. Easing of purchase tax rates and hire-purchase regulations has helped to increase sales throughout the summer and autumn, and this trend has been intensified by the publicity effort which E.D.A. and the electricity boards are now permitted to make. To these tangible changes from the situation as it was last year has been added the less defined influence of the more friendly "official" attitude to electricity: it is no longer the fashion for ministers and other politicians to suggest that the use of electrical appliances at home is in some way against the national interest. All this has encouraged the public to buy to an extent that has surprised many manufacturers. Enquiries last week showed general concern regarding the probable supply situation during the coming months: as a report on a later page shows, delivery periods are already extending and the whole process of orders fulfilled in part only, and of repeated apologies for lack of choice seems in danger of afflicting the industry once again, albeit with a happier background than during the immediate post-war years. To right the position without sowing the seeds of future problems due to overproduction will require clear thinking and courageous decision by the managements concerned. Especially does it need to be borne in mind that the buying surge is affected by the rising trend towards inflation, which has reappeared as a factor in our economy. Yet in spite of its problems, the improvement in trade is most welcome, both for its immediate contribution to prosperity and also for the assistance a buoyant home market can offer to exports.

TOO MUCH TESTING?

A significant point was raised by Mr A. R. Blandford when in his Chairman's Address to the South Midland Section of the I.E.E., reported on a later page, he referred to switchgear development. He questioned the necessity for the extensive testing now being carried out in this country on circuit-breakers, calling it (in comparison with practice abroad) both costly and extravagant. His main point was that such testing did not help manufacturers in their search for export business, as foreign buyers were more prone to rely on operational experience as a guide, and in addition he suggested that failures to clear, even in equipment of foreign manufacture which had far less testing, were not prevalent. It is

unfortunate that within the restricted ambit of his address Mr Blandford could not go into more detail on this subject, for it is of major interest. The ASTA Certificate has hitherto been regarded by British switchgear manufacturers as a criterion of quality most acceptable to the overseas purchaser, and although the cost of testing plant must necessarily play its part in the price of the switchgear, it has nevertheless been considered justifiable. If, however, it can be shown as Mr Blandford seems to infer that British switchgear manufacturers are finding themselves at a price disadvantage against their overseas competitors due to the cost of testing, some departure from the present standards may be justified. But it should not be forgotten that the present high reputation of British switchgear throughout the world is largely founded on the extensive use that has been made of short-circuit testing stations.

COAL AND OIL

During the House of Commons debate on the National Coal Board Report last week, the Minister of Fuel and Power, referring to the use of oil as a fuel for power stations, announced that the British Electricity Authority was now committed to an extensive programme of dual-firing. No less than seven of the new power stations are to be made suitable for burning either oil or coal, and oil fuel is to be supplied by the oil companies on a coal-oil "parity" basis, implying the same cost for given heat content of each type of fuel. This development can scarcely be welcomed by the Authority, which will have to bear the additional capital costs of oil storage and handling equipment. Other problems, too, will have to be solved; the higher sulphur content of oil may cause objections on amenity grounds and the effects of vanadium deposits in large unit boilers may lead to operating troubles: such deposits have already been evident in the gas turbine field and are still under investigation. Despite these objections, however, the situation must be faced that there appears little hope of obtaining the coal required to support the industrial progress and domestic requirements of the country, and until atomic energy becomes available on a large scale, the use of oil will be necessary to fill the gap.

CONTRIBUTION IN KIND

Nigeria is the largest of Britain's colonies, and since the war it has been intensely active in commercial and industrial activity and in political development. As in every part of the world, such progress is being accompanied by a growing demand for electricity, which is proving difficult to satisfy. The task is in the hands of the Electricity Corporation of Nigeria, which was formed in 1951 to take over and develop existing Government-controlled undertakings, and the difficulties which this Corporation has inherited make doleful reading as presented in the second annual report, summarised on a later page this week. Plant capacity and staff numbers are both insufficient at present, but the greatest difficulty is financial. In the long run, successful completion of the load-building plans of the Corporation may put this right, but for the present, temporary arrangements are proving necessary. Amongst them is a West African parallel of the capital contribution schemes so familiar and contentious a feature of rural electrification in this country. In Nigeria, the contracting body is a township rather than an individual consumer; and not cash, but actual buildings and labour make up the contribution required. In the result, the E.C.N. retains responsibility for providing plant, equipment, and technical staff. Such schemes are an example of the determination of the Corporation to give the widest possible supply of electricity in the face of the difficulties with which it has to contend.

BOOST FOR THE BATTERY

The Dairy Show, a London attraction last week, offers an appropriate occasion for looking at the progress of battery-electric vehicles, which are always featured prominently in this display. It is pleasing to find manufacturers now reporting well-filled order books and an encouraging flow of new enquiries. The battery-electric delivery van provides a welcome off-peak load for the supply industry, and in the street it is an eloquent advertisement for the silent and fume-free service which electricity offers in all applications. There is a field indeed for the wider use of battery-electric traction for internal as well as external transport: it seems doubtful if the advantages it offers in this application are as yet fully appreciated. With the question of electricity load-factor fresh in mind from recent tariff changes, factory managements should be particularly receptive to propaganda on this point.

EXPERIENCE ABROAD

It has become the normal practice for full-time students of technology and science to spend part of their summer vacation working with an appropriate firm or undertaking, so that practical experience may be early added to theoretical learning. The extent to which this desirable practice is leading to visits overseas is not always realised. Since the war there has been steady development under the guidance of the International Association for the Exchange of Technical Experience, a British-founded body having UNESCO's blessing, and 1954 has seen new records set for the number of students involved. No less than 4,267 went abroad from nineteen countries spread throughout Europe, North America and the Middle East: a notable increase from the creditable total of 920 students who were placed in nine countries in 1948. The average age of the students is in the early twenties, and during their stay of two or three months abroad they are usually paid at about the "unskilled" average wage for the country they visit. So widespread an exchange of young engineers as that being built up under the care of this association must have many long term advantages through spreading knowledge of what is best about each country's methods, quite apart from the wider value of the appreciation engendered of a foreign point of view. Moreover, this scheme has a great advantage over some others: the student must return to his home country and so share his experience of other ways with his fellows who stayed at home.

Meteor

Resistance Welding Control

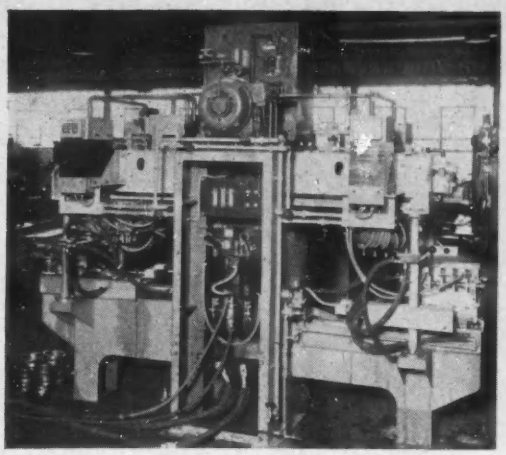


Photo by British Federal Welder and Machine Co., Ltd.

USE OF IGNITRONS IN ELECTRONIC METHODS OF SWITCHING AND CONTROLLING WELDING CURRENT

By C. J. TEECE (Lancashire Dynamo Electronic Products)

BEFORE commencing to study the application of any type of resistance welding control equipment it is necessary to examine the fundamental aspects of the process of resistance welding briefly. This type of welding is essentially a contact process, as distinct from arc welding, where external filling of the welded joint is obtained by the fusion of the electrode material into the joint. Broadly speaking, in resistance welding the process can be broken down into two or three operations. With the work between two copper electrodes, pressure is applied to the material by the operator either mechanically by means of the machine foot-pedal itself, or with the assistance of compressed air. The pressure applied is important in ensuring a good contact between the materials to be welded. When the materials are tightly squeezed together, mains potential is applied to the primary of a transformer within the welding machine, resulting in a very heavy current at low potential flowing in the secondary. The secondary circuit is completed through the copper electrodes and the work itself and intense heat is generated by the current flowing in the material. When the welding current ceases to flow the joint cools rapidly, the electrode pressure being maintained during this period.

Factors Affecting Weld

Fundamentally, the quality of weld is dependent upon three main variables; the square of the current, the effective resistance of the junction between the two work pieces (and the resistance of the metal itself), and the duration of the period during which the welding current is flowing. From the point of view of the control engineer, only two variables can be readily controlled, i.e. the current and the duration of the weld.

It is pertinent to mention briefly, the simplest methods of controlling welding conditions by electro-mechanical equipment. Fig. 1 shows diagramatically, a typical arrangement where the current can be varied only by actual tap-changing on the primary of the welding transformer, and where the duration of the welding period is controlled by a simple oil-dashpot, or similar type of timer controlling an electro-mechanical contactor. The taps on the transformer can, of course, be adjusted only when the machine is off-load, and adjustment to the mechanical timer also involves delays in the machine production. It will be seen, therefore, that any method of on-load adjustment of welding current, and an infinitely variable form of time control can lead to marked improvements in the output of welded assemblies from the machine.

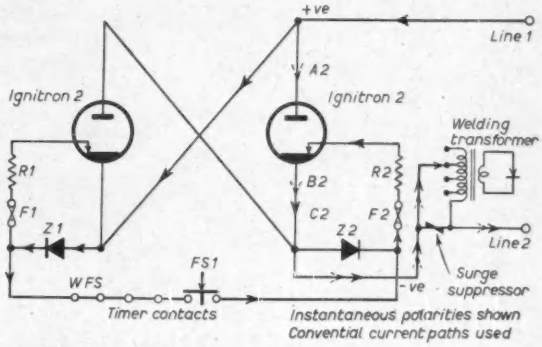
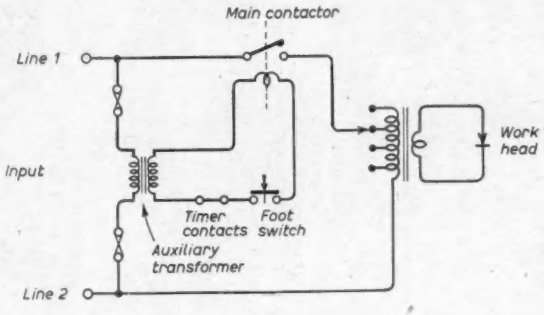


Fig. 2. Ignitron contactor unit.—Welding current varied by primary taps on transformers

Fig. 1. Simplified circuit of resistance welding machine



The use of electro-mechanical contactors for switching the supply to the transformer can, however, lead to difficulties, particularly where the welding times are extremely short, thus demanding very high operating speeds from the contactor mechanism. Such high-operating speeds, also involving the breaking of heavy currents at the contacts, can lead to severe wear on both mechanical and electrical parts. Apart from the high cost and inconvenience of replacements, the quality of the welding can suffer due to

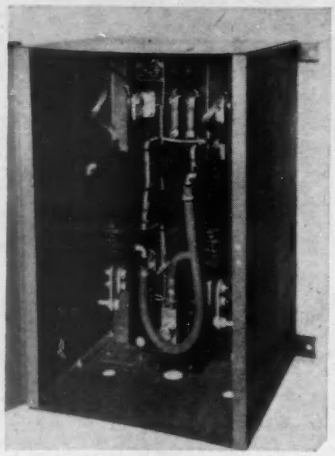


Fig. 3. The water-cooled ignitrons are clearly shown in this typical contactor panel

timing errors. Whilst arrangements using contactors are suitable for many types of welding operations, there are a number of cases where the type of work justifies the use of more elaborate control equipment. This is particularly so where the duration of the welding periods is short and where specialised alloys, and similar materials are in use, and under such conditions fully - electronic equipment enables the operative to produce a much higher standard of weld and machine output is increased.

The simplest application of electronic techniques in resistance welding lies in the replacement of the electromagnetic contactor by an electronic contactor. The electronic contactor utilises mercury pool cathode valves, known as ignitrons, which are capable of controlling very heavy currents. Fig. 2 shows a typical schematic arrangement of such a unit, fitted into the basic welder circuit. Fig. 3 is an illustration of a typical ignitron contactor, the steel jacketed water-cooled ignitron valves being clearly shown.

The ignitron contactor circuit, which is equivalent to a single pole, single throw contactor arrangement, utilises two ignitrons since the tubes can only pass current in one direction and operates in the manner outlined below.

Before either ignitron can pass current, the anode must be positive relative to the cathode and a current must flow between the igniter and the pool cathode to initiate the main arc. The tube is said to "fire" when an arc is established between the main anode and the cathode, thus enabling a heavy current to flow. In Fig. 2 the anode A2 of ignitron 2 is positive relative to the cathode B2. The tube is then ready to fire if sufficient igniter current is caused to flow in circuit C2. Since, the foot switch, FS1, is open, no igniter current can pass until the contacts of this switch are closed. When the switch is closed, in order to initiate a weld, current flows in the direction shown by the arrows and so causes ignitron 2 to fire. When the tube is passing current the voltage drop across the arc between the main anode and the cathode is of the order of 15 V only, and this reduction, from full line voltage to only 15 V, results in the fall of igniter circuit current to a fraction of that existing before the tube fires. When the tube has fired current therefore flows from L1 to L2 via the anode circuit of ignitron 2 through the primary of the welding transformer. Since current can flow in an ignitron tube in one direction only, i.e. when the anode is positive with respect to the cathode, the tube will cease to conduct if A2 becomes negative with respect to B2. This is, of course, exactly what happens when the a.c. supply reverses polarity after a half-cycle, in which the anode of A2 goes positive, has passed. For this reason it is necessary to connect ignitron 1 in inverse parallel with ignitron 2 in order to permit conduction to the welding transformer over a full cycle.

The purpose of the rectifiers shown in Fig. 2 is readily apparent if the circuit is traced in the direction of the

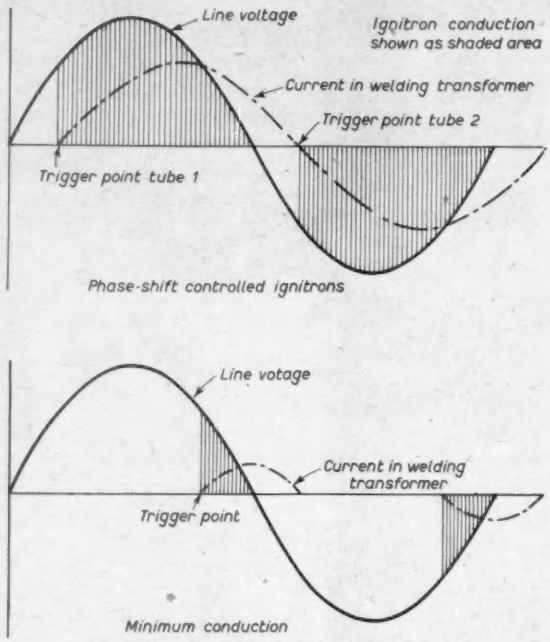


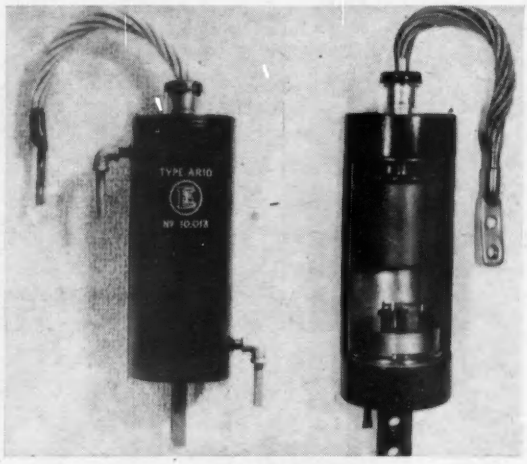
Fig. 4. (a) Shows phase-shift ignitrons at maximum conduction, (b) same conditions minimum conduction

arrows. Reverse current through the igniter will cause rapid deterioration of the tube and the rectifiers Z1 and Z2 are fitted to prevent reverse currents flowing in their respective circuits. The igniter circuits are also protected by fuses F1 and F2, and by resistors R1 and R2, which limit the peak current drawn by the igniters. Since the ignitron is normally water-cooled, a waterflow switch is essential to prevent operation without an adequate water supply (contacts on the waterflow switch are marked WFS on the figure).

When using equipment fitted with ignitrons there are one or two points which should be noted.

(1) The steel jacket of the tube is at line potential, when the mains are applied to the equipment and care should be taken to avoid contact with the exposed surfaces.

(2) The cooling water supply must be adequate or tube



Figs. 5 and 6 show typical resistance welding ignitron

life will inevitably be reduced. As an example, a typical size of tube requires a minimum flow of 1½ gallons of water per minute. It is pertinent to mention that in the experience of the author, tube failures have been caused by restriction of the flow due to reverse pressure in the water system caused by the use of a closed circuit arrangement. A free outlet to an open drain is advisable and a true flow switch should be used for protection.

(3) As in the case of normal electrical plant, the ignitron has a duty rating, but, due to the construction, the tube has a low thermal inertia. Although the tubes are designed to pass very heavy currents (ranging from 50 to 10,000 A per pair), care is necessary in deciding the actual duty cycle and reference should always be made to the manufacturer's literature which gives all the necessary data. It should be borne in mind, that, whereas an electric motor can be rated for a substantial overload for a period, of say, one hour, the overload capacity of an ignitron is limited to periods of the order of a few cycles of the supply.

(4) On no account should a pair of ignitrons be operated under conditions where the load current is less than 50 A. If, on calculation of the current this figure is not expected to be reached, an artificial load in the form of a resistance should be connected in parallel with the main load, in order to make up the current to a minimum of 50 A. In cases where the loading resistance is not required it is necessary to fit a "surge suppressor" in the form of a non-linear resistance across the welding transformer primary. This will absorb the high induced voltage when the arc suddenly extinguishes, which can cause reverse conduction or "back-firing" in the tube with consequent tube failure. Manufacturers of electronic resistance welding control equipment normally supply the loading resistance or a "surge suppressor" unit as a standard item with the installation.

The ignitron provides a compact and convenient method of handling heavy currents without requiring the use of large electro-magnetic contactors and other equipment. It will be seen from Fig. 2 that closing and opening the Switch FS1 will cause the ignitrons to commence and cease conduction. A later article will describe the use of simple electronic timers for controlling the duration of the period during which the ignitron contactor is operating.

It will be recalled that the question of on-load variation of welding current was mentioned above. The advantages of such a method of control over off-load transformer tap changing are obvious, particularly if the control equipment is capable of providing a wide, stepless variation of welding current. It has been stated previously that once an ignitron has commenced to "fire" there is no possibility of controlling the current passing in the valve. The ignitron is essentially an electronic switch and, as such, requires external control arrangements to initiate or "trigger" its operation. If, however, the external control circuits can delay

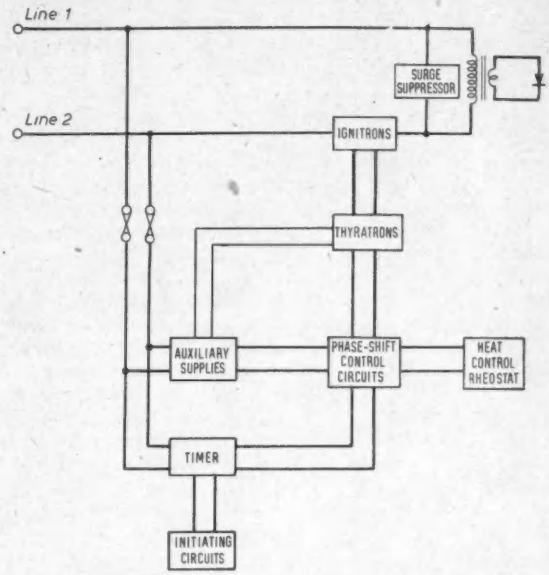
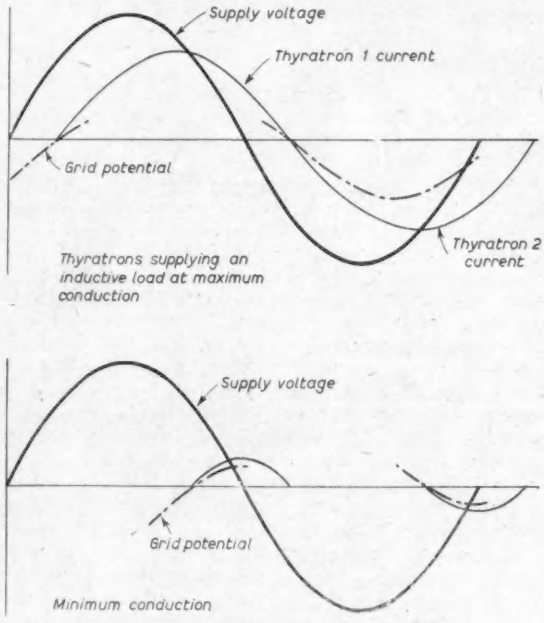


Fig. 8. Block schematic diagram of ignitron heat control panel applied to resistance welding machine

the firing of the valve in such a way to cause the tube to fire at say 90° in a given half-cycle, it is obvious that the r.m.s. voltage applied to the transformer will be lower than the r.m.s. voltage in the case of a full half-cycle conduction. By controlling the point of conduction in this manner, a variation of the welding current is obtained and thyratrons are used to initiate the ignitrons at the correct point in the half-cycle. It is not possible for this form of control to be operated over the whole half-cycle and normally the operation of the heat control is limited to within the range 30 to 150 electrical degrees.

The conditions at the two extremes of this range are shown diagramatically in Fig. 4 (a) and (b).

Fig. 7. (a) Thyratrons supplying an inductive load at maximum conduction (above) (b) minimum conduction (below)



Electronic Valves in Control Circuits

In order to provide for stepless control of the ignitron conduction angle, in the manner outlined above, use is made of electronic valves to control the firing point of the ignitrons. Valves of many types are used in industrial electronic control equipment, some very similar to those used in domestic television and radio sets, and others specially designed to carry the heavy currents involved in industrial control equipment. It has already been shown how the ignitron valve, with a mercury pool cathode, can be used to control very heavy currents. Of the smaller valves, two distinct types are used, most of those employed

for control purposes being of the hard (vacuum) type. For handling medium currents, valves which are filled with a suitable gas, such as mercury vapour or xenon, are used.

In most cases, the small "hard" valves are used in the control circuits of gas-filled types which handle the power. The pool-cathode type of tube, is, in turn, usually controlled by a gas-filled valve. In welding control equipment the small valves of the vacuum type are frequently used to control a gas-filled valve, which in turn controls the firing of an ignitron. Dealing with the typical case of the ignitron heat control panel, hard valves are used to control gas-filled valves known as thyratrons, which control the ignitrons.

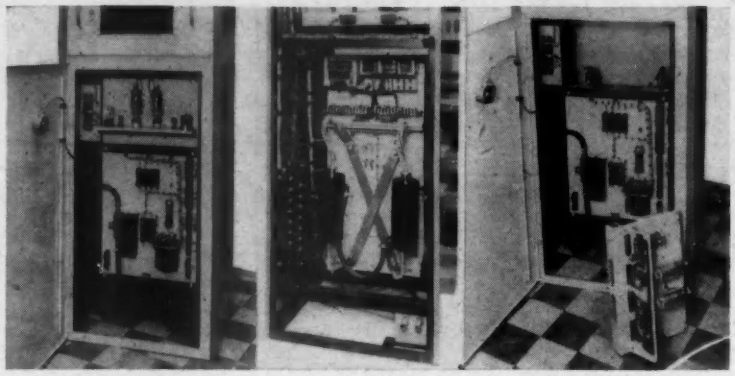


Fig. 9. Control cubicle. Left, trigger thyrations and control valves seen. Centre, reverse view showing bus-bar mounted ignitrons. Right, plug and socket connectors permit easy removal of control unit

The thyratron is a multi-electrode, vapour-filled tube of which there are two main types—hot cathode and cold cathode. In the case of the ignitron heat control illustrated in this article, the hot cathode tube is used and the description of the operation of the equipment will be confined to valves of this type. In its simplest form, the thyratron is constructed as a triode valve, having an anode, a cathode and a control grid. The electrodes are enclosed in a glass envelope into which liquid mercury, or an inert gas, e.g. xenon, is introduced after evacuation. In the hot cathode tube the filament is heated and the mercury vapourises and fills the envelope. Unlike the vacuum-type triode, the grid of a thyratron cannot be used to control the current passing in the tube by varying the bias applied to its control grid. Once the tube fires the current cannot be varied, or indeed cut-off, until the anode of the valve becomes negative with respect to the cathode. Each type of tube has a "critical" grid negative potential at which the tube will conduct, which is dependent upon the applied anode voltage.

If alternating current is applied to the anode of a thyratron, and the grid potential is taken above the critical level at some point in the cycle it is clear that the point in the cycle at which conduction occurs can be varied. A number of methods can be used for controlling the grid potential, a typical example being the use of a voltage which is varied in phase with respect to the anode voltage. In this way, the point at which the thyratron fires in any half-cycle can be controlled as shown in Fig. 7 which consists of oscillograms taken under conditions of minimum and maximum conduction over a full cycle, using two thyratrons connected in inverse parallel. By using thyratrons controlled and connected in this manner to supply the power to the igniters, the conduction of ignitrons can be similarly controlled.

Fig. 8 shows a block schematic diagram of ignitron heat control panel and in the adjacent figures a complete example of modern design is illustrated. It will be seen that, following the latest practice, the control unit is of unitised construction and plug and socket connections are fitted to simplify service problems. The advantages to be gained by the use of such an arrangement are obvious, but in particular if the phase shift control unit is believed to be faulty, it can be readily removed and a new unit inserted. It is unnecessary for the heavy current and cooling water connections to be removed and this does, of course, mean that loss of valuable production due to servicing is kept to an absolute minimum.

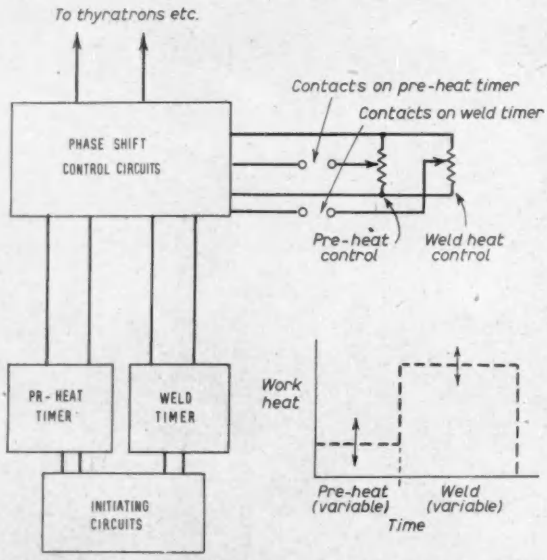


Fig. 10. Pre-heat and welding heat control using single ignitron panel. Inset diagram shows graph Work Heat/time

Conclusions

The ignitron puts a very valuable tool in the hands of resistance welding engineers and when used with phase shift heat control the operator has a stepless finger-tip control of welding current. The transformer design can be simplified, a minimum number of taps being necessary, indeed it is possible in some cases, to dispense with tap-changing altogether. Costs of machine manufacture can be reduced, although this is off-set by the increased cost of the control equipment. More important is the substantial increase in the time during which the machine is actually producing parts, and the rapid nature of any adjustments after initial setting.

It must also be mentioned that a single standard ignitron heat control panel can readily be used to provide two or more heat levels for specialised welding where "Pre-heat" or "Post-heat" operations are required. The block schematic diagram of such an arrangement is shown in Fig. 10 and it will be seen that only additional controls and light duty relays have to be added to the welding machine electrical circuits. Having considered a ready means of controlling welding current his next step is to turn to the timing of the weld duration, and the use of electronic equipment for this purpose will be the subject of the next article. *(To be continued)*

The Chairman's Address

LOCAL CENTRES AND SUB-CENTRES OF I.E.E. CONSIDER VARIED TOPICS

SOME of the addresses that have been delivered by the Chairmen of I.E.E. Centres and Sub-Centres during the past few weeks were summarised in our issue of 21st October. Here we give a further selection.

Recent advances in power engineering are discussed by MR A. R. BLANDFORD in the address he delivered to the South Midland Centre. His theme is the rising consumption of electric power and the extreme urgency attaching to efforts being made to economise in coal.

In a consideration of transmission problems, he notes especially the way in which the use of series capacitors is extending the distance over which it is practicable to use a.c. transmission. Extended use of auto-reclosing circuit-breakers may prove of economic importance by making it possible to shorten the normal overhead earth-wire protection to a distance of only 1½ miles from power stations and substations. The money so saved generally more than compensates for the additional cost of auto-reclosing, in Mr Blandford's opinion. While outages may occur in a lightning area, they are only momentary, 20 or so cycles.

On switchgear generally, he states that while the o.c.b. is in general use in this country for voltages up to 30 kV, in America, up to 13·2 kV the practice has changed to air-break c.b.s in a remarkably short time, and this trend is extending to Canada. Air-break c.b.s for such voltages are more expensive to manufacture than the orthodox o.c.b., but the Americans have saved by standardisation, being willing to restrict the customer in his choice of auxiliary equipment.

Mr Blandford questions whether the close attention given by British manufacturers to high-power testing of circuit-breakers is in fact a good thing. He suggests that there is no indication that failure to interrupt has been prevalent with circuit-breakers in service either in this country or abroad. In consequence "our costly and by comparison extravagant methods of testing are of little help to manufacturers in their search for export business. Foreign buyers, quite rightly in my opinion, are more prone to rely upon operational experience as their guide."

Measurements

Measurements in electrical engineering have provided MR D. EDMUNDSON with the subject for his address to the Rugby Sub-Centre. He recalls the great successes of mathematical analysis in the earlier years of the electrical industry, saying that there was no alternative to them. More recently, improvements in measurement techniques, particularly in the basic components of the necessary apparatus, have made possible accurate measurements of many new quantities, even under factory conditions. It is not certain, in Mr Edmundson's opinion, that electrical engineers have appreciated the change. He gives as an example the measurement of torque and mechanical power. Suitable techniques were suggested as long ago as 1906, but it was not until recent years that the basic ideas concerned were used directly to give the torque/speed characteristics of induction motors. Amplifiers and the c.r.o. have made this possible. Other illustrations may be taken from speed and temperature measurement techniques.

Innovations in measurements technique have been due mainly to men who knew what they wanted to measure, rather than to men who knew about measurements. Design engineers should master measurement techniques. Only a few hours a week are available to most practising engineers for really creative work, and there is a tendency to devote this almost exclusively to mathematics. The need is for engineers to spend such time rather in the laboratory and on the factory floor, seeing to their own measurements.

Flame-proofing

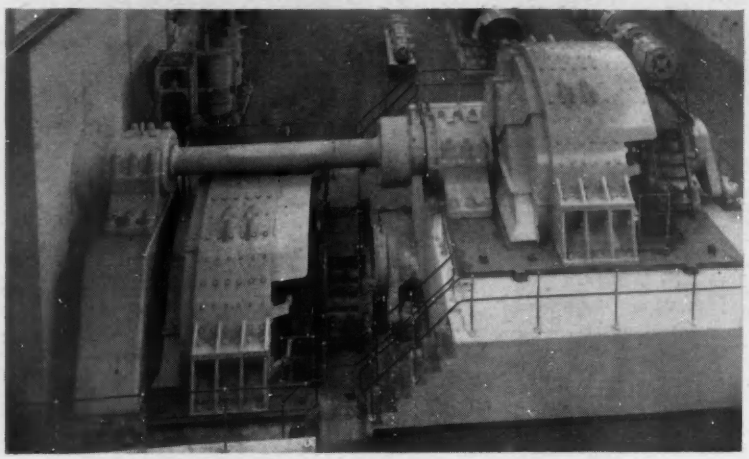
Avoiding danger where electricity has to be used in an explosive atmosphere has become of growing importance in this country with the expansion of the chemical and petroleum industries. It is a subject which gives ample scope for the address presented by MR G. D. CURTIS to the West Wales Sub-Centre. After tracing the development of design and standardisation of flameproof equipment, he goes on to discuss its use, especially in surface industries. The safety offered by flameproof gear is not absolute: it must be capable of operating safely under all electrical conditions to which it is likely to be exposed. An essential consideration is that there must be no damage to enclosures resulting from prolonged persistence of short circuit currents. In Mr Curtis' view, the maximum ratings of bus-bars, their metallic enclosures, and similar equipment should be expressed in terms of current and time. The maximum breaking capacities at present are 25 MVA at 3·3 kV and 5 MVA at 440 V.

Since flameproof systems necessarily use cable rather than open wires, it is unlikely that phase-to-phase short-circuits will occur without giving rise to earth faults. Earth-leakage may, therefore, be used as a main protection and over-current as back-up. With this arrangement, considerations of motor starting currents need not lead to long delays on the protection of the main distribution systems. All earthing connections and bonding at cable terminations and joints should be carried out particularly carefully to avoid sparking and possible ignition of explosive mixtures.

In above-ground industrial establishments, there is always an alternative to the use of comparatively expensive flameproof equipment. Electrical equipment can be sited outside danger areas, or substations may be pressurised. Pressurising leads to the risk of having to shut down all plant fed from the substation concerned. Mr Curtis considers that the balance of opinion is in favour of the use of flameproof equipment. Intrinsically safe apparatus may be used, in certain applications, and these have been extended recently to include automatic process control gear.

Chairman of the Tees-Side Sub-Centre, MR E. J. GRUBB, chose as his subject the history of the supply industry on Tees-Side. Traced from the provisional lighting orders taken out by Stockton and Darlington Corporations in 1890, up to the building of the North Tees C power station and other events of recent years, this history makes an enthralling story: but not one that is readily summarised in the space available here.

Something of the same difficulty applies to the address of DR R. C. CUFFE, chairman of the Irish Branch. In this he speaks of some Irishmen who were active in investigations into electricity at the time of Michael Faraday. He goes on to appeal for more bursaries to encourage the best of present Irish graduates in engineering to remain and work in Ireland, perhaps after obtaining experience abroad.



Drive for large steel rolling mill

It is not only the supply industry that has a rural problem: the telecommunications people are also concerned. How the difficulty is handled in the Plymouth area is described by MR H. C. O. STANBURY, in his address to the South-West Sub-Centre. A twenty-year planning period is used in installing new equipment, and the ultimate cables to distribution points are provided on this basis.

MR J. E. WHITTAKER, in his address to the North Scotland Sub-Centre enters into a discussion of available sources of "artificial" energy, with particular reference to their classification as "capital" or "revenue" according to their derivation from wasting assets, such as coal, or non-wasting, such as wind or hydro-electric generation. He goes on to discuss in some detail the functions and achievements of the North of Scotland Hydro-Electric Board, and in particular, its functions of developing the indigenous resources of its own district. Finally, there is a review in greater detail of the Aberdeen area, of which Mr Whittaker is manager.

The South-West Scotland Sub-Centre also has a supply industry chairman, MR R. J. RENNIE. In his address, he reviews the performance of distribution equipment in service on the S.W. Scotland Electricity Board system since vesting day. The system covers 5,000 sq miles, and serves 770,000 consumers with a simultaneous maximum demand of 810 MW.

Transformer faults average 0·6 per 100 per year, half being due to lightning. In considering h.v. switchgear, with 10,000 circuit-breakers in service, the average number of faults per year was 25. Despite the rapid increase in prospective fault currents consequent upon network expansion, only one circuit-breaker failure due to inadequate breaking capacity has been recorded. Incorrect functioning of protective gear occurred in 7·9% of all o.c.b. operations in the clearing of faults on h.v. networks.

Cable faults on the h.v. system average 1·12 per 100 miles per year for 6·6 kV, 8·04 for 11 kV and 3·09 for 25/20 kV. Some sections of the 6·6 kV network have been in service for 50 years, and others on the 25 kV —6·6 kV networks for 30 years. Fault incidence on such old cables has been generally better than that of cables laid during the last six years. On l.v. distributors and services, fault incidence is 7·1 per 100 miles per year.

Overhead lines account for 69% of all h.v. faults recorded. 93% of all these o.h. line faults occur on the 88% of lines operating at 11 kV. For all voltages, the fault incidence is 26·5 per 100 miles per year, of which 13·3 were due to lightning. In one lightning storm in May 1953, 303 interruptions were caused by blown fuses. Fuses are now being omitted on transformers connected to spur lines, and auto-reclosing circuit-breakers and surge absorbers are being used at certain points on the system. The use of unearthed construction is being extended in an effort to reduce the number of faults due to birds.

For the board as a whole, annual expenditure on faults has remained fairly constant at 9·3% of the total expenditure on distribution. Average consumer hours lost due to faults was less than 0·009% of maximum available consumer hours.

Energy Storage

Generating high energy impulses is the theme selected by MR J. M. FERGUSON for his address to the N. Staffs Sub-Centre. He analyses several "impulse generators" in power engineering into basic units: supply, store, convertor and switch, and compares their operation. The accompanying table summarises the possibilities of some of the stores. As one example, a hot reversing mill in a steel works may be considered. The duty of this is to reduce the cross-section of a slab from 940 to 129 sq in. in nineteen passes, occupying about 100 seconds.

The maximum energy required in excess of the steady output from the supply is equivalent to 50,000 h.p.-seconds, or $27{\cdot}5 \times 10^6$ ft/lb. If the speed of the Ilgner set concerned is not to be allowed to drop by more than 10%, then total energy for the set should be 250,000 h.p.-seconds, giving a flywheel energy alone of about 200,000 h.p.-seconds. If the energy obtained from the flywheel could be obtained from a battery (electrochemical storage), one giving 1,300 amps at 750 V would be suitable. Using a capacitor (electrostatic storage) the requirement would be 0·8 Farad at 750 V but, to quote Mr Ferguson "I doubt if there is sufficient paper in the world to construct it."

COMPARISON OF ALTERNATIVE METHODS OF ENERGY STORAGE

Type of Energy store	Volume efficiency		Duration of Pulse	Duration of Discharge	Storage Losses	Remarks
	ft lb per cu foot	watt sec. per c.c.	Max.	Min.	Watts/ft lb	
Potential Mechanical	$3{\cdot}12 \times 10^8$	0·15	Hours	Hours	Nil	Based on water storage
Dynamic	$5{\cdot}0 \times 10^5$	24	Seconds	Millisecs.	$6{\cdot}0 \times 10^{-4}$	—
Electro-Magnetic	250	0·012	Millisecs.	Millisecs.	30	Losses based on 10 millisecs.
Electro-Static	$1{\cdot}15 \times 10^8$ down to 20·5	0·052 to 0·001	Hours	Microsecs.	Very low	Impregnated Paper Condensers
Electro-Chemical	$1{\cdot}6 \times 10^6$	78·5	Hours	Seconds	Very low	Planté Cells

READERS' VIEWS

Correspondents writing under a pseudonym are asked to submit their names in confidence to the Editor

Contact Maintenance

THOSE who have conducted considerable long-term research into the performance of electrical contactors I am sure found Mr J. W. Fair's article "Contacts for Electrical Control Equipment" both interesting and salutary. Its publication coincides with the appearance in the Technical Press of a spate of rather far-reaching claims for the performance of electrical contacts.

It is probably because so many factors affect the behaviour of contactor contacts, even under apparently identical conditions, that Mr Fair with great wisdom indeed, refrained from being too specific about contact application and the only criticism one is tempted to make is that perhaps he did not stress quite enough the desirability of keeping the file away from correctly designed contactor contacts.

R. A. F. Craven, A.M.I.E.E.,
WATFORD ELECTRIC AND MFG. CO.

* * *

IT is gratifying to have Mr Craven's support for the suggestions made in my article "Contacts for Electric Control Equipment." Experience has shown that it is definitely misleading to be dogmatic about contact applications, and I had this constantly in mind when writing the article.

My remark that the golden rule is "as little interference as possible," was intended to discourage excessive attention to contacts. I did not wish to labour the point, but to emphasise that correctly designed and rated equipment does not need such treatment, and is, in fact, more satisfactory without it.

J. W. Fair, D.L.C., A.M.I.E.E.,
SHUSTOKE, BIRMINGHAM.

Danger Through Earthing

WHILST I welcome the attention drawn to this subject by "Meteor" in your issue of 21st October, I cannot agree with the conclusion he draws that the "earth-free situation" exemption from I.E.E. Wiring Regulation 1001 is too frequently neglected. The fact is that as a result of the use of metal window frames, bare plaster walls, wireless sets, hot water systems, boilers at the back of fireplaces, gas pipes, washbasins in bedrooms etc., practically no room in a modern house is entirely "earth-free." If a room is treated as being earth-free one can never be sure that the user will not bring into it an earthed appliance connected by a long flex from a socket-outlet in the hall or passage where the situation is not earth-free, or that some other alteration may not be made without the knowledge of the electrical contractor that would make the situation no longer earth-free.

Most laudable efforts are now being made to secure universal adoption of the 13-A 3-pin fused plug and socket-outlet to B.S. 1363 so that appliances can be connected anywhere in the house without having to change the plug connection; hence socket-outlets in an earth-free situation should also be of this type, but the earthing contact tube on the socket-outlet must then be left disconnected from the earthing system. After the installation has been completed the user has no means of identifying socket-outlets which have been treated in this manner, and may easily imagine that his appliances are earthed when in fact they are not, because *originally* the room was considered to be earth-free.

I am able to say that it is the considered opinion of many responsible contractors that the "earth-free situation" exemptions to the I.E.E. Regulations, insofar as they concern domestic installations at least, should be abolished, and that all 3-pin socket-outlets should be earthed.

To guard against the inherent danger in electric fires, toasters, etc., greater emphasis is now rightly being placed in the more adequate guarding of exposed elements and the use of double-pole control switches; for other appliances "double insulation" is strongly recommended. It is foolish to pretend that electricity is safe. A motor car is only safe when carefully used, and everyone knows it, but this in no way limits its popularity. Electrical appliances are also safe when properly installed and carefully used, but we do harm to the cause of electrical development by letting consumers think that there is no danger and that they can do what they like with electrical appliances.

R. A. Marryat, B.SC., A.M.I.E.E.
MARRYAT AND PLACE, LTD., LONDON, E.C.1.

* * *

I CAN assure "Meteor" that far from neglecting the exemption to I.E.E. Regulation 1001 which permits the earth contact tube of a three-pin socket outlet to remain disconnected from the earth continuity conductor, I have given the matter careful consideration and decided against the practice.

In the first place the exemption does not apply to socket-outlets supplying portable appliances having exposed metal work which are liable to be carried into non-earth-free situations. With the present range of portable electrical appliances I doubt if there is a socket-outlet in existence that is not likely to be called upon at some time or other to supply appliances in non-earth-free situations.

Consider the case of a small house with two rooms and a kitchenette downstairs and a bathroom and three bedrooms upstairs. The rear room downstairs has a metal grate with a back-boiler and the front room downstairs has a tiled grate. Assume that socket-outlets are to be provided in the living-room and bedrooms and that the electrician follows "Meteor's" advice. The rear room downstairs having a metal grate which is effectively earthed will be required by Regulation 1001 to have the earth tube of the socket-outlets in the room connected to the earth continuity conductor. In other rooms the earth tubes may be left disconnected.

The occupier of the house is a keen gardener and he sees an electric hedge trimmer demonstrated at a show and decides to purchase one. It is just the thing for cutting his garden hedge and there is already a 13-amp socket-outlet in his front room to which to connect it. He is warned by the salesman that it should be used with a 3-pin plug as the exposed metal has to be earthed; well, all the socket-outlets in his house have 3 tubes so he must be all right. Being a non-technical man he can hardly be expected to know the earthing tube of his front room socket-outlet is not connected. Does "Meteor" consider it fair to leave the layman with a snare of this type on his premises? The story can be extended to other rooms originally earth-free.

If the earthing tubes of 3-tube socket-outlets are sometimes going to be connected to earth and sometimes not, the onus of knowing whether the tube is earthed or not is being placed on the user. If a consumer is to be placed in a position where he cannot take his installation

at face value you are immediately inviting interference with the circuits by unskilled persons. It is wrong to present to a consumer with an earth tube which may turn out to be a fraud. The public have already been educated to the idea that the 3-tube socket-outlet is the correct place to plug in apparatus with exposed metal. Don't let us spoil the habit by introducing a query into the matter.

As it is not possible to guarantee that socket-outlets will not supply apparatus in non-earth-free situations it is better to see that the earth tube is always connected to the earth continuity conductors.

A. R. Gascoigne,
LONDON, N.15.

* * *

I READ with much interest "Meteor's" remarks on the dangers through earthing in earth free situations, a very debatable subject, but I do feel that to term the earthing of appliances in such a situation as "a mistaken attempt to comply with good practice" is not a justified remark.

It seems to me that the important factors are (i) How many (supposed) earth-free situations are earth free? (ii) How long after the installing of a non-earthed outlet does the situation remain earth free?

In theory "Meteor's" remarks are justified but in practice definitely not, for experience has proven to me that it is by far the better practice to install earthed points in earth-free or assumed earth-free situations than the ordinary 2-pin or 3-pin plug with the earth socket connection omitted which complies with I.E.E. Regulation 1001. With the changing of tenancies, new consumers very often bring in earths such as hot water systems, gas poker points, radio earths, etc., which completely alters the position, making the situation by far more dangerous than an earthed appliance in an earth situation. (Especially where rooms are "let".)

I have come across many situations which have been regarded as earth free but have been the cause of fire and shock. One particular fire was caused by a 2 kW fire which was "down to frame" and connected to a 2-pin plug. The fire was standing near the fireplace on the wood surround, with one leg on the head of a floor board nail which had been driven into the side of a gas pipe. Another intrusive earth: A 2-pin switch plug with a six inch strip of channelling underneath it was the means of earthing a metal fender which was touching the channelling used to protect the lead covered cable. Damp walls, etc., are also unforeseen dangers.

Today, many electrical appliances are fitted with local switches, usually of the single control pole type, making the use of 2-pin reversible plugs in earth-free situations not in accordance with I.E.E. Regulations (608 (K). The alternative is to install a 3-pin plug and omit the earth connection to the earth contact tube of the socket which is in accordance with Regulation 1001. This has been the cause of many an accident and can only be regarded by the practical man as bad practice. Firstly it is misleading and when an earth is introduced within its vicinity the consumer invariably assumes the outlet to be earthed.

I do feel however—especially in these days when there are many electrically minded handymen operating—it would be a step in the right direction if appliances were fitted with d.p. switches which would safeguard the consumer from fire and shock. A switch plug connected wrong polarity is a very common discovery.

A. Stopford, Installation Inspector, S.E.E.B.,
GRAVESEND, KENT.

* * *

I FEEL that a very important point with regard to safety and earthing has arisen in this week's issue of the ELECTRICAL TIMES. It appears under the headings of "Danger Through Earthing" (p. 577) and "Accidents at Home" (Intrusive Earth, p. 586). This subject takes into account I.E.E. Wiring Regulation 1001 Note 2, which reads:—"In earth-free situations the connection of an earth-continuity conductor to the earth contact-tube of a socket-outlet may be omitted, except where the socket-outlet is to supply portable appliances having exposed metalwork which are liable to be carried into non-earth-free situations while connected to that socket-outlet."

I would like in all sincerity and due respect to challenge this regulation in the following manner. I would like to see this departure from modern trend and practice withdrawn forthwith. My contention is, that whenever a 3-pin socket-outlet is fixed or fitted, it must be effectively and efficiently earthed irrespective of whether its situation be earth-free or otherwise. Connection to "earth" of appliances in an earth-free situation is entirely another matter: it is taken for granted by the majority of the public today, especially in the domestic field, that where a 3-pin socket-outlet is fitted or fixed, it has an effective earth continuity conductor connected to its earth-tube. I feel that this situation does not permit the earth-connection to any 3-pin socket-outlet to be omitted, as this, without doubt, gives a false idea of the state of affairs and can be dangerous.

If the earth-connection is to be omitted, then the socket-outlet must be of the 2-pin type only. The fact that the 3-pin socket-outlet does not warrant an earth continuity conductor in certain circumstances (earth-free situations) does not prevent anyone connecting a long length of flexible 3-core cable to it and operating a portable appliance (electric drill, etc) from it in a garden hut or out of doors, on the understanding, that as the plug is connected into a 3-pin socket-outlet, the appliance is efficiently earthed. We all are too familiar with fatalities resulting from this very thing. In conclusion, the point I wish to make is: wherever a 3-pin socket-outlet is fixed or fitted, the earth-tube shall have an effective and efficient earth conductor connected to it.

J. H. Robinson,
THORNTON, FIFE.

Brunswick Wharf

I WAS very interested to read the article on the Brunswick Wharf Power Station, also Mr S. G. Christian's subsequent letter. I must confess that I also looked in vain for the names of Messrs R. Illingworth, O.B.E., M.I.MECH.E., M.I.E.E., and W. J. Andrews, A.M.I.MECH.E., A.M.I.E.E.

I can remember Mr. Illingworth describing his proposals and I, as a junior, was completely fascinated. I had much pleasure in seeing it grow to its present state of construction. I can only reiterate Mr S. G. Christian's remarks and conclude by endorsing his sentiments.

W. J. Ablett,
LONDON, N.1.

Yellow or White

THE article in this week's issue on the above subject seems to miss the boat. I find when driving at night the cars one meets with yellow headlamps do not dazzle as much as those fitted with *clear* lamps and I find most drivers agree with this. Surely one fits pearl lamps not *clear* indoors to prevent glare.

I also think if everyone fitted yellow headlamps the practice of driving on side lights giving no forward light, which is not safe on any road other than roads with the latest type of street lighting, would be prevented.

The sodium lighting is more restful than other types.

I think the case for yellow headlamps is very well put in an article in *The Motor* dated 24th March, 1954.

W. A. Pass,
WEYBRIDGE, SURREY.

Prophecy and Fulfilment

THE SUPPLY SECTION CHAIRMAN'S ADDRESS

AS a starting point in his chairman's address, Mr J. D. Peattie took the classic Inaugural Address delivered by Mr S. Z. de Ferranti in 1910. This dealt with coal conservation, home-grown food and the better utilisation of labour. In Ferranti's vision, he came to the conclusion that the only complete and final solution of the question was to be obtained by the conversion of the whole of the coal used for heat and power into electricity, and the recovery of its by-products at a small number of great generating stations. The vision, said Mr Peattie, of 1910, was the obvious fact of 1954. For the present, electricity was supreme as the most useful link in the chain of conversion from the fuel to use. Ferranti did not, however, confine himself to generalities, he gave estimated figures to support his views. He took the 1903 figures as a basis when the home consumption of coal was 150m tons, excluding 2m tons going to coasting steamers and 15m tons used by gas works. He proposed to take 60m tons of coal only, convert it to 131,400m kWh and supply the whole of the country's varied requirements.

Since that time great strides had been made in the efficient use of coal in many differing directions, particularly, as Ferranti foresaw, by conversion to electricity. Curiously enough, there had been little change in the coal production position although consumption for statutory generating stations had risen from 3m tons in 1903 to 37m tons in 1953/4. From this quantity of coal, 63,000m kWh of electricity were generated.

Controversy still raged about the best chain of conversion processes to satisfy our heat needs. Ferranti pointed out that with electricity we had close control for use in the required amount precisely where it was needed. It was also in a form in which it was most difficult to waste or use improperly. In industry today there was still a wide field for electric process heating. As the efficiency of generation from low-grade fuels rose, and the use of nuclear fuels became significant, conditions would increasingly favour electricity for process heating. In this connection, there was one large-scale application of electricity for heating purposes mentioned by Ferranti which even today might sound fantastic. This was that iron ore should be smelted electrically, the coke being used for the chemical reduction process only. Our rise as an iron and steel producing nation had been bound up with the use of magnificent British hard coking coals. These are now within sight of exhaustion, and the native coal was being replaced by imported oil.

Other Uses

Mr Peattie said that he could not refrain from referring to railway electrification. He shared the recent heartfelt sigh of *The Times* leader writer: "There may be some reason why Great Britain, with its shortage of large coal (which is now being imported) and with the smoke-laden air of its cities and its rising transport costs may still be the one country in which the old form of steam locomotion remains the most economic. But it is unlikely." An excellent example of British understatement.

Direct electrical use for chemical processes, particularly in the production of light metals and alloys, had been multiplied many times by the demands of two wars, and we were only on the fringe of developments in that respect. Returning to coal, there was now a sharp distinction between carbonisation and industrial coal. The latter was steadily decreasing in quality. Coal generally remained in short supply and it seemed possible that we were committed indefinitely to the import of coal or other foreign fuels. The problem of fuel conservation, for the nation, had indeed become acute. As electrical engineers we could, however, face the problem with some confidence. The country was now nearly covered with a network of transmission and distribution lines connecting the great generating centres together and to the ultimate consumer. At the generating centres we were beginning to gain control once more after the tremendous strain of war and post-war conditions. At the end of July, 1954, the B.E.A. had an installed capacity of 19,000 MW in 281 stations. Ferranti's prophetic 1910 figure of 25,000 MW in 100 stations was being approached. The average thermal efficiency of generation at 23·54% was also in sight of Ferranti's figure of 25%. We should certainly pass that within a year or two. The size of sets was increasing. From the 30 MW sets of the 1930's the sizes are now 60 MW, and 120 and 200 MW sets are due for installation in 1959 and subsequent years. The average size of set in the 1947 programme was 40 MW; in the 1959 programme it would be 85 MW. Similarly the average boiler capacity in 1947 was 260 klb/hr; in 1959 it would be 660 klb/hr.

Difficulties in the Way

It was impossible to avoid concern at the difficulties in the way of achieving the objective of more power. Some of these arose from the relations between the supply industry and the community. Two of these problems were the use of rivers and estuaries as cooling water sources, and the discharge of flue gases and dust into the atmosphere. Even increasing use of cooling towers could not provide a solution to the restrictions being imposed by River Boards under their new powers, and as a result new sites using rivers were becoming increasingly difficult to find. Suitable coastal sites were more scarce than a glance at the map would suggest. The pollution problem could be separated into two distinct parts, one concerned with the emission of solid particles, and the other with emission of gases such as sulphur dioxide. Rapid steps had been made in the improvement of the efficiency of electrostatic precipitators which held the field in this country for the extraction of dust from flue-gases. Much work was still being carried out and recent experiments at Little Barford had shown that the dust quantity settling within two miles of the station was so small that it could not be measured with certainty by standard instruments.

As far as sulphur compounds were concerned, the costly experiments on flue-gas washing at Battersea, Fulham and Tir John led to the conclusion that the best solution to the problem was to discharge the hot unwashed gases from high chimneys into the upper layers of air, well clear of buildings where they were dispersed innocuously over wide areas. The proposed use of oil with its higher sulphur content added to the difficulties. It was debatable whether better results would not have been obtained at Bankside —an oil-fired station—without gas washing. Similar problems would also arise in the disposal of radio-active residues from nuclear stations and would have to be dealt with as their nature became known.

notes on wiring

by Megohm

THE farmer who is without electricity today must be at a considerable disadvantage. To those in the electrical industry, a visit to a modern farm is like the proverbial "busman's holiday." Whether the farm is a dairy farm, stock farm, crop farm, or a mixture of these, there is plenty to interest the engineer and, very often, much to discuss. The electrical installation must stand up to many hazards which include dampness, heat, mechanical damage and use by people who are not too familiar with electricity. Another very important factor is that all animals are extremely sensitive to electric shock and have often been killed by a low voltage which would be comparatively harmless to a human being. It is, therefore, most important that skilled men are employed on the original installation and on any additions and/or alterations carried out. I feel that local electricity boards can do much in stressing this point to the farming community.

Wiring Systems

Careful consideration must be given to the choice of system for the farm. I mentioned a few of the hazards which may be met, and it is obvious that they vary with the type of farm. For instance in cowsheds and stables there is the presence in the atmosphere of free ammonia and moisture. A steel conduit job is always liable to suffer from condensation and corrosion and an "all insulated" system with p.v.c. insulated and sheathed cables would no doubt prove the most satisfactory. Non-metallic conduit would prove satisfactory in such situations and would, in addition, provide the facility for the withdrawal of the cables if required. It is important that cables and conduits should be kept well out of the way of mechanical damage. P.V.C. cable is non-inflammable which is a most desirable feature. Farm buildings are usually scattered and not inter-connected, and it is, therefore, necessary to provide wiring between these buildings, and here again consideration must be given to the type of cable used. Underground cable is, of course, the best practice but this is expensive. It can also be unsafe unless the cables are installed well below the ground surface and adequately protected. There is much heavy traffic around a farm and the wheels of the carts, etc., sink well into the ground during the wet weather. The alternative method is to use p.v.c. insulated cables run on galvanised steel catenary wire and fixed to it by lead straps, or use cable made-up with catenary wire. These overhead lines must be erected at a sufficient height above the ground to enable any loaded farm wagon to pass underneath with ample margin of safety. The minimum clearances at lowest points should be (*a*) across roads—19 ft; (*b*) beside roads—17 ft; (*c*) where inaccessible to traffic—15 ft. Spans should average 150 ft and not exceed 180 ft. I need not emphasize the need for good fixings at the anchor positions of the overheads and, in view of the rather weak construction of certain wooden outbuildings, it is advisable to use some form of plate on the inside of the anchor arrangements. I think it would be quite safe to embrace all farm building installations by classing them as "weatherproof" installations. There always appears to be dampness present on the farm.

Lighting and Power

A high degree of illumination is not necessary on the farm except in the cowsheds and milk handling rooms. In the cowshed, lighting at a fairly low angle should be provided to give effective illumination on the udders during milking and cleaning. One angle reflector and one general light to every three stalls will provide reasonable illumination, but one angle light between each pair of stalls will ensure that each cow is effectively lighted on both sides. The lighting brackets should be mounted high enough to prevent any damage by the animals. Where glass-type lighting fittings are installed care should be taken to ensure that, in the event of breakages, the fragments will not cause harm to the animals by contaminating foodstuffs. It must be remembered that there is practically no reflection from the walls and roofs in such places and, therefore, a higher lamp wattage is required to compensate for this loss.

Much can be said about milking machines from an economic and hygienic point of view. That, however, is a topic for the farmer. Our main interest is in the type and size of the motor and the wiring to it. A milking machine consists of a simple rotary vacuum pump driven by a motor. Depending upon the size of the milking installation, the motor might range from ½ to 1½ h.p. I have heard farmers argue that an electric motor is not so satisfactory as a petrol one, but their reasons are usually just a knowing nod of the head and some remark to the effect that the animals know too.

Every electric motor should be provided with efficient means of starting and stopping, and these controls should be readily accessible. This is most important, for on farms I have visited the motor control gear appeared to be the place to hang wet clothes or park a vehicle close by. Additional "stop" buttons should be employed where work is carried out some distance from the main motor controls. I find it advantageous to have such buttons painted a brilliant red in order that they can be easily identified in a case of emergency.

Earthing

This, as always, is perhaps the thing which matters most in electrical installations, and specially on farms. I feel that in these installations to rely on the usual method of earthing the system via the "cold water pipe" is really courting danger. The conditions prevailing in many parts of the farm, i.e. exposed metalwork, stone floors, dampness, etc., necessitate the utmost care for the protection of personnel and livestock. Suitable earth-leakage protection devices should be installed and much trouble can be avoided if the manufacturers of such equipment are called in at the planning stages. Their experts, I feel sure, would welcome such consideration, for all too often these protective devices are wrongly blamed for the sins of the installers. Much has already been said and written on the qualities of e.l.c.b.s without further mention by me.

SIMPLE CONTROL SYSTEMS

Part 5. In this article the further study of continuous variable systems introduces types having three storage elements and operating from sampled information

By P. D. ATKINSON, M.A., A.M.I.E.E.

IN the last article in this series first and second order systems were considered. The first part of this article is concerned with third order systems, that is systems which contain three separate energy storage elements.

In Fig. 1 is shown a schematic diagram of a speed control system for a large d.c. motor. In this system the output quantity, which is the speed of the motor, is measured by means of a tachometer generator. The output voltage of this machine is compared with the input quantity and the difference is amplified to control the supply to the motor armature. Part of the amplification is by electronic valves and the last stage by a field controlled d.c. generator.

If we omit the smoothing circuit at the input of the amplifier there are only two significant energy storage elements, the inductance of the generator field and the inertia of the motor; the system is therefore of the second order. However, in practice, the ripple caused by the commutator of the tachometer generator may be so large that it overloads the sensitive amplifier and thus interferes with the operation of the system. It may therefore be necessary to reduce this ripple by introducing a smoothing circuit such as the simple one shown in the diagram. With this additional storage element the speed control system becomes third order, therefore the time delay caused by the smoothing circuit affects the dynamic properties of the system.

Influence of Smoothing Circuit

In order to study the nature and magnitude of the influence of this smoothing circuit it is necessary to formulate the equation of motion of the system and to solve it.

Let V = the speed of the output shaft (radians/sec).
k = the tachometer generator voltage per radian/sec (volts/rad/sec).
e = the input voltage (volts).
m = the gain of the electronic amplifier (volts/volt).
G = the gain of the generator amplifier (volts/amp).
S = the total armature circuit resistance (ohms).
T/g = the motor torque per amp (lb ft/amp).
P = the motor armature e.m.f. per radian per second (volts).
J = the moment of inertia of the moving parts (lb ft²).
q = the charge on the smoothing capacitor (coulomb).

Then, considering the smoothing circuit,

$$q = C\,V_c$$

and the current flowing into the condenser is equal to the rate of change of q

$$\therefore\quad q' = \frac{(e-kV)-V_c}{r}$$

$$\therefore\quad rCV'_c + V_c = e - kV \qquad \text{.....(1)}$$

The voltage applied to the generator field circuit is mV_c and therefore.

$$mV_c = Ri + Li' \qquad \text{.....(2)}$$

where i' is the rate of change of i.

In the combined armature circuit

$$Gi - PV = SI \qquad \text{.....(3)}$$

and by Newton's second law of motion we have, neglecting friction and load torque, for the rotating parts coupled to the motor shaft

$$T\ I = JV' \qquad \text{.....(4)}$$

From equations (1) and (2)

$$(e-kV)m/R = i + (T_2+T_3)i' + T_2\,T_3\,i'' \qquad \text{.....(5)}$$

where $T_2 = rC$ and $T_3 = L/R$,

and from equations (3) and (4)

$$i = [V + T_1V']\,P/G \qquad \text{.....(6)}$$

where $T_1 = SJ/PT$.

Combining equations (5) and (6) we get the equation of motion of the system.

$$V''' + X\omega_0V'' + Y\omega_0^2V' + \omega_0^3V = \frac{e\omega_0^3}{(1+mGk/RP)}\,\frac{mG}{RP} \qquad \text{.....(7)}$$

where $X = \left(\frac{1}{T_1}+\frac{1}{T_2}+\frac{1}{T_3}\right)\frac{1}{\omega_0}$

$$Y = \left(\frac{1}{T_1T_2}+\frac{1}{T_2T_3}+\frac{1}{T_3T_1}\right)\frac{1}{\omega_0^2}$$

and $\omega_0^3 = \frac{1}{T_1T_2T_3}\left(1+\frac{mGk_i}{RP}\right)$

Equation (7) cannot be solved by the graphical method used in previous articles and either mathematical or numerical methods must be used. These methods are outside the scope of this series of articles but the results are important. The left-hand side of this equation is entirely characteristic of a third order system. The form of the right-hand side depends on the way in which the three energy storage elements are arranged in the system. However the recovery of such a system from an initial displacement is independent of the form of the right-hand side of the equation.

The general form of the recovery from an initial displacement is similar to that of a second order system in that the motion may be a damped oscillation or a slower recovery without overshoot. If the third order system has an

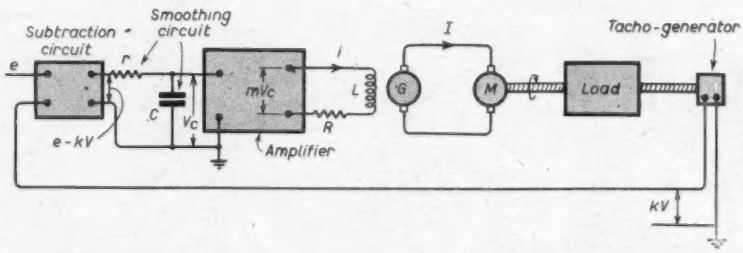


Fig. 1. This example of a third order continuously variable control system takes the form of a motor speed controller with a smoothing circuit at the amplifier input

oscillatory response the motion consists of the sum of a damped oscillation, Fig. 2a and a non-oscillatory recovery Fig. 2b. Thus the actual response is of the form indicated in Fig. 3(a). In order to achieve a rapid recovery it is therefore necessary to so design the system that both the oscillatory and the non-oscillatory terms decay equally rapidly. Values of the parameters which give roughly equally rapid decay of both and thus minimise the recovery time are X=1·5 Y=2·92. Fig. 3 (b) shows the calculated recovery of this control system when X and Y have these values. The time scale of such response curves depends only on ω_0 while the degree of damping and form of the the response curve depends only on the two dimensionless coefficients X and Y.

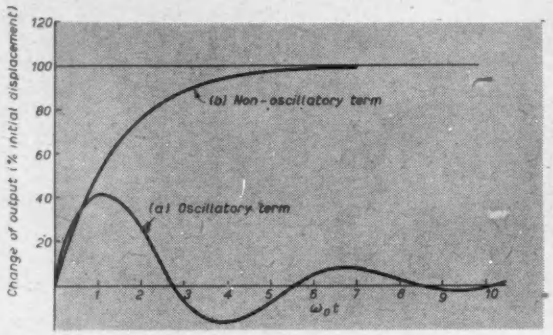


Fig. 2. The two components of the characteristic of a third order system, in which X = 1·36 and Y = 1·85, recovering from an initial displacement

It was shown in the fourth article of this series that if the gain of the amplifier in a second order system is increased in order to reduce the error caused by a steady external disturbance, then the speed of response is increased and more damping is required. Similarly in the case of the third order system discussed above, an increase of mGk/RP will improve the steady state accuracy when a steady external load torque is applied and it will also increase ω_0, thus increasing the speed of response. However, in order to maintain adequate damping the coefficients X and Y must be kept high and, therefore, it is necessary to reduce the quantities $1/T_1+1/T_2+1/T_3$ and $1/T_1T_2+1/T_2T_3+1/T_3T_1$. In practice it may be very difficult to reduce the time constants T_1, T_2 and, T_3 beyond a certain point.

Thus it can be seen that it may not be practicable to improve the static accuracy beyond a certain value without sacrificing the stability of the system whether it be of

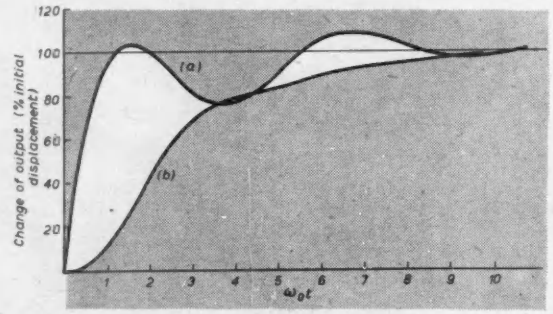


Fig. 3. Actual responses of a third order system recovering from an initial displacement. Curve (a) is the combination of the two curves shown in fig. 2 whilst curve (b) is the response of the same system when X = 1·5 and Y = 2·92

second or third order. It can be shown that exactly the same limitations exist in the case of high order systems. There are other practical restrictions to the static accuracy which can be achieved by simply increasing the gain of the amplifier. Examples of such additional restrictions are as follows:

(i) As the speed of response of a system increases all the elements in the system are required to operate more rapidly. Various small time delays caused by small energy storage elements, which, in the analysis of a slow-acting system could be neglected, become increasingly important and ultimately cause instability.

(ii) As the gain of the amplifier is increased, non-linear effects such as amplifier saturation, non-linear friction, and back lash in gear trains become more significant and may cause the system to oscillate.

(iii) Another result of increasing the gain of the amplifier is that small, unwanted a.c. voltages caused by electrical noise and mains hum may overload the amplifier and thus paralyse it. It should be noted that the circuits used to introduce artificial damping generally increase the tendency of the amplifier to be overloaded in this way.

Integral Control

The steady state accuracy of almost any system can be improved very considerably without significantly affecting its dynamic performance. The method used to achieve this improvement is called Integral Control. It consists of arranging for the very low frequency gain of the amplifier to be increased many times without appreciably affecting the response of the amplifier to signals which change at a rate associated with the transient response of the system. This is achieved by arranging for the amplifier output to be the sum of two quantities; the first is the normal quantity proportional to the error in the output quantity of the control system; the second increases with

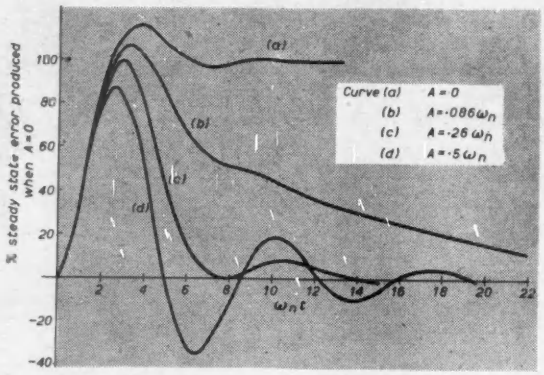


Fig. 4. Responses of a position control servomechanism, in which α = 0·5, to the sudden application of load torque, for varying degrees of integral control incorporated in the system

time at a rate proportional to the error in the output quantity. Thus, if the amplifier output causes action which tends to reduce the error, the error correcting action will go on increasing until either the system overloads or the error is reduced to zero. Moreover, the amplifier, provided that it is not overloaded, will continue to give the output signal required to overcome the external disturbance after the error has been reduced to zero. The two terms in the amplifier output are named, proportional and integral, respectively.

Let us now consider the effect on a second order system of modifying the amplifier characteristic so that its output

consists of both a proportional and an integral term.

In the last article the device chosen as an example of a second order system was a position control servo-mechanism used for the control of the output of a continuously variable ratio transformer. We will now consider the effect on this system of a steady torque suddenly applied to the output shaft and the way in which integral control will correct the error caused by this torque.

Then, using the same symbols as before, i.e.

V = the angular displacement of output shaft from the balance position (radians).

V′ = the angular velocity of output shaft (radians/sec).

V″ = the angular acceleration of the output shaft (radians/sec^2).

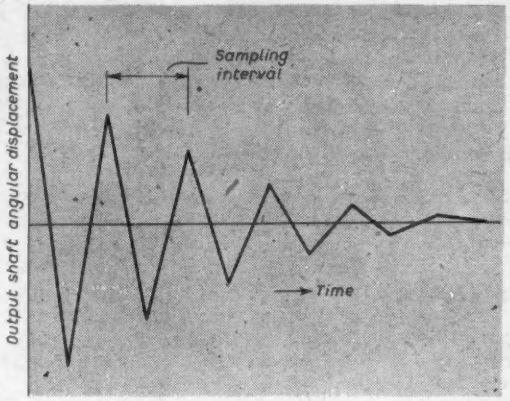


Fig. 5. Depicted here is an example of a second order position control system which is able only to sample the error signal at regular intervals, when $n/4\pi + \pi/2n < \alpha < n/2\pi$

g = the acceleration due to gravity (ft/sec^2).

F/g = motor torque per amp of field current (lb ft/amp).

k/g = friction torque per unit angular velocity (lb ft/radian/sec).

I = moment of inertia of the moving parts (lb ft^2).

m = voltage error per radian displacement of the output shaft (volts/radian).

K = the amplifier gain (amps/volt).

T/g = the externally applied torque (lb ft).

Then we have $i = mKV$ ..... (8)

The torque available for accelerating the motor = Motor torque − [friction torque + applied torque].

Then by Newton's second law of motion

$$V'' = -(FKm/I)V - (k/I)V' + T/I$$

or $$V'' + 2\alpha\omega_n V' + \omega_n^2 V = T/I \quad \text{..... (9)}$$

where $\omega^2_n = FKm/I$ and $\alpha = k/2\omega_n I$

Curve (*a*) in Fig. 3 shows the way in which a system for which $\alpha = 0{\cdot}5$ will respond to the sudden application of the torque T. After the transient has decayed there will be a steady error in the position of the output shaft equal to $T/I\omega_n^2$ radians.

If the amplifier characteristic is modified so that its operation can be represented by the equation

$$i' = Km[V' + AV] \quad \text{..... (10)}$$

The equation of motion becomes

$$V''' = -(FKm/I)[V' + AV] - (k/I)V'' + T'/I$$

or $$V''' + 2\alpha\omega_n V'' + \omega_n^2 V' + A\omega_n^3 V = T'/I \quad \text{..... (11)}$$

Thus the inclusion of an integral control term has changed the second order system into a third order one since this equation contains the third rate of change of the output quantity. Curves (*b*), (*c*) and (*d*) in Fig. 4 show the response of the same position control system but with varying degrees of integral control added when subject to the same applied torque. From these curves it can be seen that the steady error caused by the applied torque is eliminated by the inclusion of the integral control term. As A is made larger the recovery action becomes more rapid but if A is made too great the system becomes oscillatory. Thus the choice of the correct magnitude of the integral control term is important.

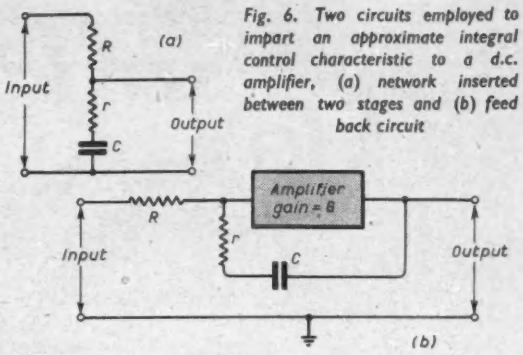


Fig. 6. Two circuits employed to impart an approximate integral control characteristic to a d.c. amplifier, (a) network inserted between two stages and (b) feed back circuit

The amplifier characteristic assumed above implies infinite gain at zero signal frequency; this is clearly impracticable. In practice it is necessary therefore to use devices which give approximately the desired characteristic. Satisfactory approximations can be achieved economically in mechanical, hydraulic, pneumatic and electrical systems. Two circuits which are used to modify the characteristics of an electronic d.c. amplifier to give a reasonable approximation to the ideal performance are shown in Fig. 6. In Fig 6a is shown a simple network which is inserted between two stages of the amplifier. To achieve a good approximation to the desired characteristic it is necessary to make $R \gg r$ Then, referring to equation (10), $A \doteq 1/rc$. The feedback amplifier circuit shown in Fig 4b also provides a good approximation if $R[G+1] \gg r$. The value of A is then as given above.

Three Term Controller

The simplest type of amplifier in a closed loop system is that in which the output is instantaneously (or approximately so) proportional to the input. Two important modifications have now been discussed. In the fourth article a method of improving the stability of a system by introducing artificial damping was described. In this the amplifier output contained an additional term proportional to the rate of change of the amplifier input. This additional term is called the "derivative" control term. In this article a form of amplifier characteristic which includes an "integral" control term has been described.

In the automatic control of industrial processes (as are found in chemical plant), use is frequently made of an amplifier which gives proportional, derivative and integral terms. These amplifiers which are known as "three term controllers" may be pneumatic or hydraulic and, less commonly, electric. It is not usual in this field of application to design a controller for use with a particular plant; they are manufactured as standard units and provided with means of adjusting the relative magnitudes of the three terms so that the best values for each control system can be determined.

Sampling Control Systems

In continuous and discontinuous control systems considered in these articles all the signals have been continuous in time. There are, however, many practical systems in which some of the quantities are interrupted at regular

intervals of time. In some systems only the input quantity is interrupted while in others either the signal indicating the output quantity or that indicating the difference between input and output quantities is interrupted.

In the former type, since signals circulating round the loop are not affected the stability of the system is unchanged. The design problem is simply that of following a changing input quantity the magnitude of which is not available all the time. In the latter type, however, the control loop may be open for much of the time and it is to be expected that under such circumstances the normal conditions for stability will no longer hold.

This type of discontinuity of signal is found wherever measurement of the output quantity cannot be made continuously. Suppose, for example, that the quality of the product of a chemical plant is to be controlled in some way by a closed loop system and that this quality can only be determined by a process which involves taking a sample and carrying out a test on it, such as a titration. This process may be carried out automatically but nevertheless information to the control system about the output quantity can only be made available after each sample has been tested, that is intermittently. Then the frequency with which samples can be taken and the time delay in producing a test result after sampling, are likely to have an important effect on the stability and performance of the system.

"Chopper Bar" Controllers

Another common example is to be found in systems incorporating a "chopper bar" controller. In this instrument, which is a very sensitive power controlling device, a weak electrical signal (as that from a thermocouple) is fed to a sensitive meter movement and causes a proportional deflection. At regular intervals the pointer is clamped automatically and its position registered either by causing a more robust mechanism, driving a precision-wound potentiometer to align itself with the pointer or by using the clamped pointer to operate electrical contacts. By this means the instrument is transformed into a very sensitive power controlling device. The result, however, is a rather unorthodox closed loop system. For, when the movement is free, no signal is transmitted to the follow-up mechanism or contacts and when it is clamped the signal representing the output quantity is blocked. However, although the loop is never completely closed signals are clearly transmitted round it.

A detailed study of such systems is outside the scope of this article but some results for a second order system are given here to show the way in which the frequency of the sampling process affects the properties of a closed loop system. Let us consider the effect on a second order position control system of sampling the signal representing the error in the position of the output shaft at regular intervals of time. The system is assumed to be damped by the introduction of a network into the amplifier such that the amplifier output $=K_1\, e+K_2\, e'$ where e is the error in the position of the output shaft and e' is the first rate of change of e. In the fourth article in this series it was shown that the degree of damping of a second order system depended only on a dimensionless factor α in the equation of motion and that the time scale depended only on a second factor p. Referring to Fig. 5 in that article it can be seen that if α is zero the system oscillates continuously with a natural period T where pT is approximately equal to 6·3. Thus the system is completely defined by the quantities α and T. Normally a value of α in the range 0·8 to 1 is preferred.

Suppose that the error in the output shaft position is measured at regular intervals of t seconds and that a memory circuit is included in the amplifier so that, during each interval, a constant voltage equal in magnitude to the last measurement of the error signal is maintained at the input of the amplifier. The mathematical analysis of such a system is difficult and only the results are given here. If we write $T=nt$, that is n is the number of sampling periods in the natural period of oscillation of the system, then for a system in which n is greater than 6, it can be shown that:

(i) If α is less than $\pi/2n$ the system will oscillate continuously with a periodic time approximately equal to T. Thus, in the presence of sampling, continuous oscillation can occur even when α has a finite value. For example if α is 0·2 the system will be unstable if n is less than 8.

(ii) If α lies between $\pi/2n$ and $1-\pi/2n$ the response to a change of input quantity is very nearly a damped sinusoidal wave as in the case of a normal continuous system with α less than 1.

(iii) If α lies between $1-\pi/2n$ and $n/4\pi+\pi/2n$ the response is heavily damped Normally there will be one overshoot which is reduced in size as n increases. If n is very great the recovery takes place without any overshoot.

(iv) However, if α is greater than $n/4\pi+\pi/2n$ but less than $n/2\pi$ the response is quite different and consists of a damped saw tooth oscillation with a periodic time equal to 2t, as shown in Fig. 5. The damping of this response decreases as α increases.

(v) Finally, if α exceeds $n/2\pi$ the system will oscillate continuously with a saw tooth wave form of period 2t.

If n is less than 6 continuous saw tooth oscillations occur whatever the value of α

The practical conclusions to be drawn from these results are that there must always be at least 6 samples/natural period of the system and that α should never exceed $n/4\pi+\pi/2n$. Thus if $n=6$ α must be less than 0·75, and by (i) above it must be greater than 0·26. In practice if it is desired to make α about 0·8, then n should be made somewhat greater than 10 in order to allow a reasonable margin for variation in the values of the components which determine α.

This concludes the study of the transient response of closed loop systems. In the next article we shall be concerned with the response of such a system to sinusoidally varying signals of constant amplitude and frequency. This analysis leads to a powerful method of predicting the stability of closed loop systems which is particularly useful in the study of high order systems.

(To be continued. Parts one, two, three and four of "Simple Control Systems" appeared in our issues of 1st April, 13th May, 8th July and 29th July and Part six is to be published shortly.)

Is Compatibility Necessary?

LAST week's discussion before the Radio Section questioning the necessity for compatibility for a colour television system in this country aroused sharply divided views, as would be expected when consideration of the most suitable system is yet hardly out of its infancy. Generally, however, speakers came down in favour of compatibility (in which a black and white receiver is able to receive colour transmission). The opening speaker Mr E. P. Wethey pointed out that for both classes of user, compatibility was desirable. Moreover, the introduction of a colour-television system would be the last chance for a revision of television standards for some considerable time, and for this reason consideration should be given to using a 625 line system for colour, transmitted in Band IV. It is also likely that conversion equipment would be standardised to enable these 625 line signals to be converted to the 405 system.

TRAINING ELECTRONIC ENGINEERS

NOW in operation at Chelmsford are the new laboratories of the Marconi College. The college was originally founded in 1901 and the new block, which began building in 1953, is designed to cater for the increased number of post-war students. The British students are nearly all employees or apprentices of Marconi's Wireless Telegraph Co. or of other companies within the English Electric Group. Some overseas students, sponsored by governments or by customers and agents are also accommodated. Several College Courses are given, but the majority of students take an engineering course of five months duration in radio, radar or television.

The college now possesses two lecture rooms, ten laboratories, a workshop, a drawing office school, a technical library, and teaching staff rooms where personal tutorials and group discussions can take place. The previous college building is now being converted as an extension to the existing hostel, where each student has a private study, bedroom centrally heated and equipped with hot and cold running water. Accommodation at the college is sufficient for nearly 100 students and the residential accommodation is ample for fifty.

Tuition is at an advanced level, the ideal qualifications for admission being a university degree in communications or electronics, although a degree in science, engineering or mathemetics, or equivalent qualification is acceptable provided some knowledge of radio has been obtained. Training is largely individual, the students working in pairs or groups of three when in the laboratories.

Marconi College is probably the oldest foundation of its type in the world, having been inaugurated by Marconi himself some fifty-three years ago. The present Principal is Mr R. E. Burnett, M.A., A.M.I.E.E., A.INST.P., and the Director of Studies is Mr R. G. Hulse, B.SC.

Permanent Magnet Excitation

A SMALL high frequency inductor alternator, in which the excitation is provided by a permanent magnet instead of a d.c. field winding, has been produced by the British Thomson-Houston Co., Ltd. The advantages of this machine lie in the cheapness—due to the absence of a separate supply—and greater reliability.

At the moment, the machines are being built for a rating of 250 VA, 115 V, 1,600 c/s at 2,400 r.p.m. and are totally enclosed, water-tight up to shaft level and fully shockproof. A machine of comparable physical size, if ventilated, should be capable of an output of 1 kVA.

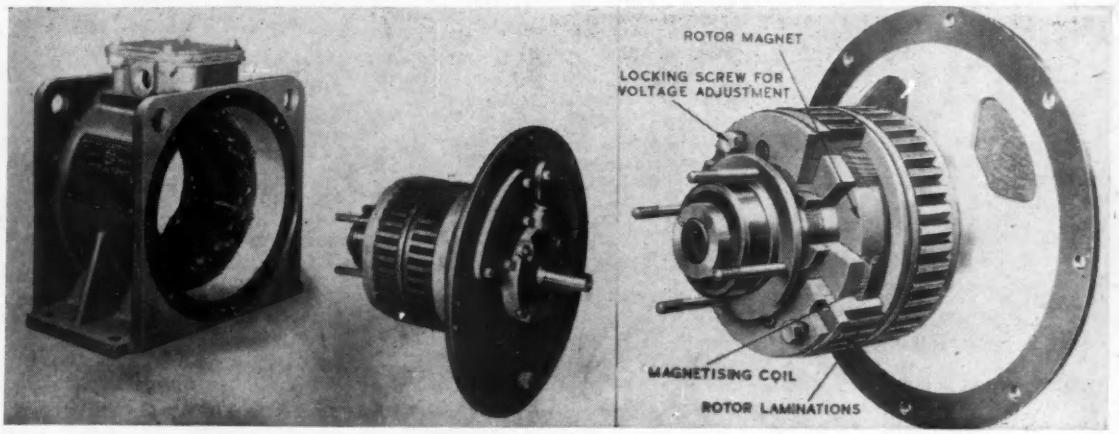
Construction

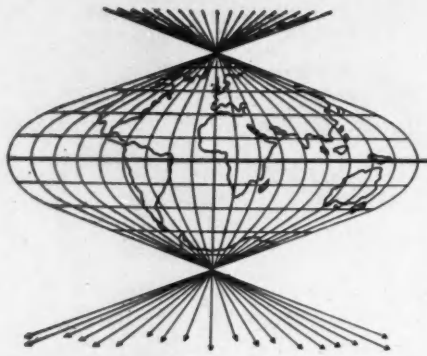
The general construction of the alternator is shown in the photographs. It is of homopolar design having an annular magnet of "Alcomax III" incorporated in the rotor, with a rotor shaft of non-magnetic steel. A magnetising coil is wound over the magnet with its end brought out to terminals mounted on the rotor end-flange. During manufacture a current of about 100 amperes is passed momentarily through the coil to magnetise the rotor in an axial direction. An important feature is that the rotor can be removed without loss of magnetism. If, however, the rotor itself is dismantled it is necessary to remagnetise after reassembly, but this can be done quite easily by means of the coil. Tests show that the rotor magnetism is not effected by the most drastic short-circuits applied to the output winding, even by short-circuiting through a series capacitor which resonates with the winding inductance at operating frequency.

Provision is made for sufficient adjustment to cover variations in manufacture and materials by varying the angle of offset between the teeth of the two rotor cores. As is usual with h.f. alternators, a capacitor is connected in series with the alternator winding to improve the load regulation characteristics. With such an arrangement the regulation from full-rated load to open-circuit may be as low as 20%. Thus for many applications where close voltage regulation is unnecessary or where the load varies over a small range, the permanent magnet machine is eminently suitable.

Initially the alternator was designed for use as the pilot exciter of a turbo-alternator set with "Magnestat" automatic voltage regulation, the permanent-magnet machine providing the magnetic amplifier with a convenient high-frequency supply to allow small physical size and high speed of response in the amplifier.

Construction of the alternator is illustrated in these two assembly pictures. The magnetising coil can be seen in the view on the right





OVERSEAS NEWS

A SUMMARY OF IMPORTANT EVENTS

CANADA

Another Set at Sir Adam Beck

The fifth 100,000 h.p. generating unit has been put into operation at the Sir Adam Beck Niagara generating station No. 2 of the Hydro-electric Power Commission of Ontaria. Another seven sets are scheduled to be placed in service by the end of 1955.

Maintaining Newsprint Supply

An additional 5,000 kW steam turbo-alternator was put into service last month at the New Brunswick International Paper Co.'s power plant supplying the newsprint mill. The official ceremony was performed by Mr Flemming, Premier of New Brunswick. It is stated that this additional power plant will help to stabilise maximum newsprint production. Shortages of hydro power in the past have compelled a reduction in groundwood production during certain periods.

New Brunswick's Need

Future industrial expansion in New Brunswick hinges on whether the provincial government can raise sufficient money to finance hydro-electric power developments, the Minister of Municipal Affairs, Hon. T. Babbitt Parlee, declared earlier this month. Terming the main needs of the province an increase in population and industrial growth, Mr Parlee said these objectives could be achieved only if the province had sources of cheap electric power. He emphasised that the New Brunswick government had been planning major steps towards improving the power situation, and all that was needed now was the money.

B.C. Wary

A further explanation of the basis of negotiation in connection with the extended use of waters of the Columbia River basin for hydro-electric power, given by Mr Sommers, the Lands Minister, should reassure those who feared that British Columbia was likely to grant U.S. concerns the sole benefit of those waters. Mr Sommers has stated that the Kaiser company's project (to which we have referred), would not in any way interfere with whatever power development, using Columbia River water, that British Columbia might undertake in the future. He emphasised that so far the Kaiser Co., had only been given permission to survey for a dam site below the Arrow Lakes. If the project proved feasible, negotiations would be opened, for which the B.C. Government was ready with its terms. These would require delivery to British Columbia of one-fifth of the power generated. To this would be added another $1 million in revenue from water rental and taxes.

CHILE

Credit for Development

The Chilean Development Corporation has been authorised to obtain certain foreign credits with four continental firms for the supply of power generating equipment to the towns of Iquique and Punta Arenas and the extension in Central Abanico. The firms and the sums involved are: Sulzer Freres (1,883,000 Swiss francs), Oerlikon (365,000 Swiss francs), Escher Wyss (1,100,000 Swiss francs) and A.E.G. (U.S. $195,000).

ETHIOPIA

Power Plant Wanted

As an immediate step to ease the local power shortage it is proposed to install an additional 5,000 kW of generating plant at the Ethiopian reserve thermal power station in Addis Ababa. It is intended that this plant should be in operation by June 1955, before the rainy season starts, and because of the urgency, the Government is seeking tenders for either a single 5,000 kW set or two of 2,500 kW each. The plant is required to operate at an altitude of 2,400 metres above sea level, maximum temperature 28° C, the temperature of cooling water being 23° C. It is emphasised that the installation of this additional generating plant is only intended as a stop-gap measure to tide over the period until power becomes available from the proposed Coca dam scheme, which is likely to be about four or five years hence.

S.W. ASIA

Station Using Sui Gas

An Italian concern has been awarded a contract to act as consultants in the erection of the thermal power station in Pakistan. This contract has been awarded to the Montecatini Co. by the Pakistan Industrial Development Corporation. This new power station in South Punjab is to have an installed capacity of 120 MW, it is stated, and will utilise natural gas obtained from the Sui gasfield. We reported on 5 Aug. that the Montecatini Co. had been authorised to prepare a project report on the scheme. It has also recently been stated that the Pakistan Industrial Development Corporation has contacted British manufacturers in connection with its plans for this new central power station.

Cost of Rural Electrification

Approximately Rs. 100 millions will be needed every year for rural electrification schemes in India, it is estimated by the Co-ordination board of Ministers of River Valley Projects. At the meeting of the board last month it was agreed that rural electrification should be speedily developed, in order to promote small scale and cottage industries. For this purpose they suggest that rural electrification should be subsidised, and that the various States should draw up schemes.

U. P. Scheme

Work is now in progress on the installation of generating plant and other equipment at the new Pathri power station, which is intended to meet the needs of the western parts of Upper Province, India. The station is situated about nine miles from the head of the Ganga Canal at Mayapur. Civil construction work has been completed. The station will have an installed capacity of 20,400 kW, operating under a head of 30 ft. It is now suggested that the existing Bahadarabad power station, on the Ganga Canal, should be replaced by combining the four falls of Ranipur, Bahadarabad, Salempur and Pathri, each having a drop of nine feet, by the constructing of a channel to by-pass those falls and obtain a total drop of 36 ft.

Work in Rajasthan

The Rajasthan Government proposes to spend about Rs.90 millions on various power projects which are to be completed by April 1956. Meanwhile existing power stations are being supplemented with additional generating capacity before the main schemes are completed. This is expected to take place by the middle of 1955. Power from the Bhakra-Nangal project will be received at Ganganagar and Rajgarh. By 1962 this will cater for the requirements of 61 towns and villages

in Ganganagar, Bikaner, Churu, Jhunjhunu, Sikar and Nagpur districts. Of these, 34 towns are already electrified, but due to lack of sufficient power capacity, supply of electrical energy for industries and agricultural requirements is restricted. A network of transmission lines aggregating 785 miles has been proposed, at a cost of Rs. 24 millions. It is proposed to spend about Rs. 500,000 for the electrification of promising rural areas in these districts. It is hoped that with availability of cheap power, mineral development in the State could be undertaken on an extensive scale. A textile mill may also be set up

AUSTRALIA

Victoria's New Station

The new 30 MW steam power station at North Geelong, of the State Electricity Commission of Victoria, was officially opened last month by Mr Galbally, the Minister for Electricity Undertakings. The station burns open-cast coal. At the ceremony, Mr R. A. Hunt, chairman of the Commission, said that completion of the station brought to a successful end a project started three years ago when the Commission had ordered from America £11 million worth of "packaged" power station plants. The North Geelong station was the largest of these.

Regional Board Wanted

The Mirani Shire Council is seeking the formation of a regional board to control the distribution of electricity in rural areas. This move follows the receipt of a report from the council representative on the Mackay City Council electricity committee, Councillor T. W. J. Soper, in which he said it was suggested that the electrification of the Mackay district was a project too large and becoming too unwieldy for the Mackay City Council electricity committee. He suggested that a regional board would be a solution.

S.A. Expansion

Over 675 million units were sold by the Electricity Trust of South Australia during the twelve months ended 30 June last, it is shown in the annual report tabled in the State Parliament. The increase in unit sales amounted to 99 million units. From a total revenue of £7·8 millions, a surplus of £353,986 was achieved. The Trust's Leigh Creek coalfield undertaking also showed a surplus of £26,295 for the year. Osborne power station used 332,365 tons of Leigh Creek coal during the year—exceeding the combined tonnages of all other fuels used. Coal produced from the open cuts totalled 352,684 tons, a decrease of 7% on that of the previous year. However the greater quantity of fines reclaimed brought the total to 455,510 tons, an increase of 14%.

Brisbane's Tariffs

An increase in electricity tariffs in the Brisbane City Council's area of supply, to operate after the next meter reading, is estimated to average about 3·8% on the total revenue from the Council's electricity undertaking. Without this increase, there would be a deficit in the undertaking's accounts for the year ending 30 June next. It has been brought about by increased capital charges and higher bulk supply rates. The present tariff increase would bring the Council's tariff rates more into line with the metropolitan rates of the Southern Electric Authority.

NEW ZEALAND

Contractors v Supply Authorities

A protest against the "menace" of competition of power supply authorities with private electrical traders in New Zealand, has been sent to Mr Holland, the Prime Minister, and Mr Goosman, Minister in charge of the State H.E. Department. The unanimous decision to do so was taken at the annual conference of the New Zealand Electrical Federation recently. It was stated that in Wanganni, the stage was being reached where it was a pitched battle between the power board and the contractors. Mr A. J. Beck (Wellington), said he felt some supply authorities were indulging in unfair trading. They were selling equipment on the basis of no profit at all and balancing their accounts with revenue from power supplied. Some supply authorities had even sold washing machines at a loss, he alleged. But many other members thought that in the main the Federation got on well with the supply authorities.

Overcoming Difficulties in Nigeria

SUBSTANTIAL progress has been made in recent months in the installation of additional generating plant and on other constructional schemes by the Electricity Corporation of Nigeria. But although a tighter grip has been obtained on the numerous small undertakings taken over in 1950, it is evident that the Corporation is still handicapped by inherited defects to which we previously referred. The report of the Corporation for the year ended 31 Mar. 1953, shows that during that period twelve generating sets totalling over 6,020 kW were installed at seven sites. Much additional plant is in process of installation at the Corporation's 21 existing power stations, but it seems that the demand is liable to outrun the pace of installation, for warning is given that the progress on new construction work has been slower than anticipated.

Of the new stations, Ijora "B", which is to have two 12,500 kW steam turbines, is not expected to be in commission until early 1956. In the meantime, additional diesel plant is to be installed at Ijora "A" as an emergency measure.

In the Cameroons hydro-electric scheme, the first 750 kW set was put into operation at Njoke during the year covered by the report, but here again difficulties were met. It seems that the scheme was designed on insufficient hydrological data, and it has now been found that in the rainy season, when the highest output should be expected, the rise in the level of the tail race (caused by backing up of a tributary) is higher than that which occurs in the headworks under the same flood conditions. In practice the possible output of the station varies between 550 kW under the best (dry season) conditions to practically zero under conditions of maximum flow. It is hoped to construct modifications which will improve matters.

Nevertheless the Corporation is seeking to develop the hydro potential of the country while utilising as far as possible other local fuel resources. Detailed survey has been made of sites on the River Niger, in the Ogun River valley, in the Shiroro Gorge, on the Kwa River and at Gurara, Tapa, Execution and Kafanchan Falls, but from data already obtained it seems that many of these are not as promising as at first believed. Work is also being carried out by the Nigerian Coal corporation to determine whether local coal seams could be worked economically. For use at Oji River power station, where two 5,000 kW steam turbo-alternators are being installed, coal is to be transported direct from the mine at Enugu to the power station, a distance of 15½ miles, by aerial ropeway. Delivery will be at the rate of 12½ tons per hour. Cost of this scheme is £180,000, but coal will be delivered to the station at a transport cost of 6d. per ton mile, compared with 13s. 6d. per ton by road transport. There had been earlier hopes that coal seams underlying the site of the Oji River station could be exploited, but further investigation indicated that the use of Enugu coal would be more economical.

The lignite reserves in the neighbourhood of Asaba, estimated at over 62 million tons, may prove a boon to the Corporation who have in mind establishing a pithead station, with high pressure, high temperature plant in the Western Region. Another proposal under consideration for supplying electricity to small communities, is that the local populace should provide the power station building, stores, housing, labour, etc., while the Corporation supply the plant and technical staff. It is felt that this arrangement would minimize the capital needs of the Corporation. For at the moment, the Corporation's programme is seriously affected by lack of adequate capital.

Due to uneconomic tariffs, an unsatisfactory accounting system (because of lack of suitable staff), and the acquisition of four more native undertakings running at a loss, operations of the Corporation for the year covered by the report resulted in a net loss of £262,810, although the number of units sold — 76·9 millions — increased by 21·5%. Steps are in hand which, it is hoped, will soon remedy the position.

Personalities

IN THE INDUSTRY

At present district manager for Dorking and Epsom to the South Eastern Electricity Board, **Mr W. B. Hayden,** M.I.E.E., has been appointed to a similar position for the Board's Sutton district. Prior to nationalisation of the industry, Mr Hayden was borough electrical engineer of the Epsom and Ewell Corporation undertaking for seven years. A native of Chichester, Mr Hayden began his career with the Chichester Electric Light and Power Co. He afterwards went to the Leatherhead and District Electric Supply Co. and in 1913 to Epsom as junior charge engineer. After war service he returned to Epsom where he was appointed power station superintendent in 1926, deputy electrical engineer in 1931, and borough electrical engineer ten years later.

Sir Alexander Roger has resigned from the chairmanship of Telephone Properties, Ltd, but will remain a director of the company. He has been chairman of the concern since its incorporation in 1931. He is succeeded in the position of chairman by **Mr A. F. Roger.**

Mr R. D. Armstrong and **Mr H. P. Jones** have been appointed joint managing directors of Senior Economisers Ltd. **Mr A. E. Armstrong** has retired as managing director but retains his seat on the board.

Mr S. I. Ainsworth, B.SC.(ENG.)., A.M.I.E.E., A.M.I.MECH.E., has been appointed deputy superintendent at Huncoat (Accrington) power station, North West, Merseyside and North Wales Division, B.E.A. He was previously second assistant engineer (operation) at Liverpool, a position which he had held since 1948, and was formerly with Fulham Corporation Electricity Dept.

Mr R. P. Sayers, M.S.M.A., ASSOC.I.E.E., has been appointed to the board of Astral Switchgear Ltd. He is also a director of Ashley Accessories Ltd, and their sales manager.

Just appointed chairman of Marco Refrigerators Ltd. for one year is **Mr E. G. Batt.** He succeeds in that position **Mr A. E. Leach** who has resigned from the board. Mr Batt, it will be remembered, became a director of Marco Refrigerators last May, after retiring at the end of March from the position of director and secretary of the British Refrigeration Association which he had held for seven years, prior to which he was independent chairman of the Association.

We learn that **Mr R. T. Conlon** has been promoted to the position of sales manager of Hellerman Ltd, and its associated company, Bowthorpe Electric Co, Ltd. The Sales Department is still controlled by the sales director, **Mr N. L. Keen,** who will continue to be responsible for the sales policies of the respective companies.

Mr Cyril Derry, who is chairman of Bassett-Lowke Ltd, and other concerns, has been elected national chairman of the Incorporated Sales Managers' Association.

Formerly senior charge engineer at Battersea, **Mr T. J. C. Stockton** has been appointed deputy superintendent at Stockport generating station, North West, Merseyside and North Wales Division of the B.E.A. Before moving to Battersea, Mr Stockton held appointments as charge engineer at Southport, Mexborough, Percival Lane and Croydon "B" power stations.

Having attained the retiring age, **Mr B. C. Wilkins** relinquished his position of chief accountant of W. T. Henley's Telegraph Works Co., Ltd, at the end of last month. He is, however, retained in the service of the firm for special duties. Mr Wilkins is succeeded as chief accountant by **Mr S. H. Nunnerley,** A.S.A.A., A.M.I.I.A., who was formerly an accountant with British Insulated Callender's Cables Ltd., and earlier served with Deliotte, Plender and Griffiths and Co.

Mr Stanley G. Smith, Scottish manager with J. H. Tucker and Co., Ltd, having completed 50 years continuous service with that company, a jubilee dinner was held in his honour at Grosvenor Restaurant, Glasgow, recently, when **Mr J. B. Tucker,** managing director, presented Mr Smith with a television set on behalf of the directors.

Formerly chief engineer of Furzehill Laboratories Ltd., **Mr R. J. H. Branthwaite,** B.A., A.M.I.E.E., has been appointed by R. B. Pullin and Co. Ltd., as superintendent of the new Electronic Division of their Development Laboratories. The creation of this post is a part of the company's programme for the progressive expansion of their development facilities, which will include the design of various electronic equipment.

General manager of the Wellington City Council (New Zealand) Transport and Electricity Departments since 1942, **Mr L. B. Hutton,** M.C., B.E., M.I.E.E., has retired from that position. He was president of the N.Z. Electric Supply Authority Engineers' Institute in 1935, and of the N.Z. Institution of Engineers in 1944.

Mr G. D. Worthington, director of Cable Covers Ltd, is now on a business tour in the Union of South Africa, the Rhodesias, Kenya and Uganda.

Mr C. H. Frankland, M.I.E.E., has been appointed representative of British Insulated Callender's Construction Co., Ltd., resident at the Trafford Park Works of B.I.C. (Submarine Cables) Ltd., responsible to the general managers of the two companies for liaison on submarine cable matters. Mr Frankland is well known throughout the electrical industry in this country and overseas for the important part he has played during the

Mr R. P. Sayers

Mr S. H. Nunnerley

Mr S. G. Smith

Mr R. J. H. Branthwaite

Mr C. H. Frankland

past 35 years in the installation of electric cables of all types, and for his contribution to modern advanced practices of installation and jointing. He is a director of British Insulated Callender's Construction Co., Ltd.

Divisional transmission engineer with the South Eastern Division, B.E.A., since 1948, **Mr C. F. Bolton,** M.B.E., A.M.I.E.E., retired this week. Prior to nationalisation of the supply industry he was transmission engineer for the South East England area of the C.E.B. On Tuesday last, Mr Bolton received a cheque from his Divisional colleagues, which was presented by **Mr W. C. Parker,** M.I.E.E., M.INST.F., the Divisional Controller. At a gathering at Bankside House last Friday Mr Bolton also received another cheque, which was presented to him by **Mr F. J. Lane,** O.B.E., M.SC., M.I.E.E., deputy chief engineer (transmission), B.E.A., on behalf of his old C.E.B. friends and other acquaintances.

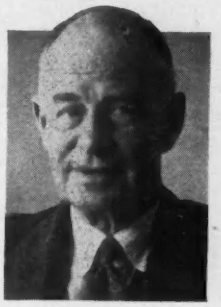
Mr A. G. F. Farquhar, O.B.E., assistant secretary, Electricity Division of the Ministry of Fuel and Power, is now in Nigeria on a three-month visit to advise the Electricity Corporation of Nigeria.

Rear-Admiral (L) Sir Philip Clarke, K.B.E., C.B., D.S.O., has ben elected president of the British Institution of Radio Engineers.

Sir Walter Puckey, president of the Institution of Production Engineers, has accepted the invitation of the Postmaster-General to serve as a member of the Television Advisory Committee, filling the vacancy caused by the resignation of **Mr E. M. Fraser.** The membership of the committee has also been extended to include **Sir Robert Fraser,** Director-General of the Independent Television Authority.

Mr S. A. Clarke B.SC.(ENG.), D.F.H. (HONS.), M.I.E.E., has been appointed Electrical Engineer (Construction) to the London Division, B.E.A. After training at Faraday House and later with Robey and Co. and the English Electric Co. Ltd., Mr Clarke was appointed technical assistant with the Brompton and Kensington Electricity Supply Co. Ltd. in 1925. He transferred in 1927 to the London Power Co. Ltd., where he held several positions in the Meter and Test Department. At vesting date he was appointed 2nd assistant engineer in the Technical Department, followed in 1949 by promotion to senior assistant engineer.

The retirement is announced of **Mr J. C. Wrighton,** M.I.E.E., the general sales manager of Automatic Telephone and Electric Co. Ltd. Mr Wrighton has been associated with the Telephone Industry throughout his career. He served an apprenticeship with the National Telephone Co. and, after take-over of that company by the British Post Office in 1912, gained



Mr C. F. Bolton

Mr J. C. Wrighton

Mr P. G. Hieatt

experience in various sections of the Industry with Peel-Conner Telephone Works, British L. M. Ericsson, Western Electric Co., and Relay Automatic Telephone Co. He joined Automatic Telephone Manufacturing Co. in 1929, as home sales manager, and was later promoted to the position of general sales manager. He was one of the original members of the Liverpool Local Board of the Company, on which he served until his retirement. In addition, he became a Director of Communication Systems Ltd., and the Pioneer Telephone Manufacturing Co. Ltd. Mr Wrighton is retaining his directorship of Communication Systems Ltd., and his services will be available in a consultative capacity to the parent organisation, Automatic Telephone and Electric Co. Ltd. At a ceremony to mark his retirement, Mr Wrighton was presented with a console television set subscribed for by members of the staff. Other presentations of a grand-daughter clock and a portable radio set were made respectively by fellow members of the local board and members of the overseas sales staff.

Mr P. Ralph has been appointed manager of the Scottish branch sales office of the British Aluminium Co. Ltd., in succession to **Mr M. J. J. Richards** who has become assistant manager of the firm's London branch sales office.

A recognised authority on combustion problems, **Mr B. Samuels,** M.I.MECH.E., has retired after 52 years service with Babcock and Wilcox Ltd. After some years spent in the Erecting Department, he was transferred to the Testing (now the Service) Department. He was appointed in charge of this work immediately after the 1914-18 War and the next 25 years was spent in building up the Service Department until it reached its present world-wide status. He has been associated for some quarter of a century with the British Standards Institution. He has served on the General Council and is a member of the Engineering Divisional Council, the Council for Codes of Practice and the Solid Fuel Industry Committee. As a member of the Heat Engines Committee appointed by the Institution of Civil Engineers he took an active part in the preparation of the Boiler Test Code, which has been in use since 1927. The work has now been taken over by the B.S.I. and the preparation of a draft revised code by a joint committee of the B.S.I. and I.Mech.E., of which he is chairman, is now nearing completion. Mr Samuels was a member of the Technical sub-committee of the war-time Fuel Efficiency Committee of the Ministry of Fuel and Power. He was also responsible for the organisation of the Pulverised Fuel Conference held by the Institute of Fuel at Harrogate in 1947.

Secretary and commercial officer of the North of Scotland Hydro-Electric Board, **Mr W. D. D. Fenton,** B.SC., M.I.E.E., has been appointed deputy chief executive officer of the Uganda Electricity Board. On his arrival in Uganda in January next, he will become deputy chairman of the Board. Mr Fenton, who is a barrister-at-law, has held his present post since 1948 having joined the North of Scotland Board in 1943 as commercial engineer. Educated at Edinburgh University and trained with the B.T.H. Co., he served with Kennedy and Donkin before becoming assistant engineer (commercial manager's staff) with the C.E.B. in London in 1933. Five years later he became personal assistant to the general manager of Midland Counties Electric Supply Co. It will be recalled that Mr Fenton went out to Uganda in April last for a short visit, in an advisory capacity to the Uganda Electricity Board.

After more than fifty years in the Electricity Supply Industry **Mr P. G. Hieatt,** M.I.E.E., M.INST.F., will retire in December. He commenced his career with the North Metropolitan Electric Power Supply Co., and held successive power station appointments at York, Rotherham, Derby, Croydon and Hackney until 1931 when he was appointed control engineer of the M.E.E. area of the Central Electricity Board, later becoming senior assistant operation engineer. He was operation engineer of the combined M.E.E. and N.E.E. area of the C.E.B. from 1946 to 1948 and upon nationalisation was appointed system operation engineer, British Electricity Authority, Yorkshire Division. More recently he was appointed personal assistant to the Divisional Controller and latterly has carried out special duties in the Division.

Mr Hieatt was hon. secretary of the original Southern Division of the E.P.E.A. from 1922 to 1931.

OBITUARY

Mr J. W. Jackson, M.I.MECH.E., A.M.I.E.E., formerly of the North Eastern Electric Supply Co, died recently at his home at Caistor, Lincs.

Mr R. E. Grime, M.SC., M.I.E.E., an electrical designer who was formerly with Mather and Platt Ltd., died on 26 Oct.

Mr Evelyn Boys, M.C., F.C.I.S., who was secretary of the Northmet Power Co. for over 41 years (apart from during the 1914-18 war), died on 30 Oct., aged 70. During his long period of service he was also secretary of a number of distribution companies, including Hendon, Harrow and the Bedfordshire, Cambridgeshire and Huntingdonshire Electricity Co., also the London and Suburban Traction Co., and its subsidiary tramway companies, the Metropolitan Electric, London United and the South Metropolitan. Mr Boys was always a familiar and popular figure in Northmet activities until his retirement at the end of Nov. 1947.

Mr W. B. Scourfield, technical representative for the Jackson Electric Stove Co., covering the Eastern Electricity Board's area, died on 24 Oct. aged 63. He had been with Jackson's since 1937.

Mr J. J. Hammond, a former director of Oldham and Son Ltd., died last week, aged 71. He retired from the board of the company last year after 54 years continuous service.

Mr R. V. MacRory, M.B.E., M.I.E.E., city electrical engineer of Londonderry for the past 56 years, died on 31 Oct., aged 76. He became chief at Londonderry in 1898 at the age of 20 after completing an apprenticeship with Siemens Bros.

A former chairman of the State Electricity Commission of Victoria, Australia, **Mr G. G. Jobbins,** M.I.E.E., M.I.E.(AUST)., died on 10 Oct. He retired from the chairmanship of the Commission in 1949, a position he had held since December 1937. Earlier, Mr Jobbins was engineer and manager of the Melbourne Electric Supply Co's undertakings at Melbourne and Geelong. When the company's business was transferred to the State Electricity Commission in 1930, he became engineer and manager of the latter's Electricity Supply Department.

Mr A. J. Stiling, A.M.I.E.E., a director of Geo. E. Taylor and Co. (London) Ltd., died on 28 Oct., aged 68. He had been with that concern since 1900, and a director since the firm was converted to a limited company in 1944. An active member of the Electrical Contractors' Association of which the firm have been members since 1917, Mr Stiling was elected to E.C.A. membership in 1943. He served as vice-chairman of the London branch from 1950-1952 and was elected branch chairman in 1952, in which capacity he served until 1954.

NEW LITERATURE

Electricity Undertakings of the World

ONCE again presenting a mine of information concerning electricity supply undertakings, this 64th edition of the Red Book conforms strictly to the successful pattern of its immediate predecessor. Approximately half the volume is devoted to the B.E.A., its Divisions and Area Boards, for which the information has been brought up to date as far as possible. There follows details of electricity supply concerns throughout the Commonwealth, followed by particulars of numerous foreign undertakings. In many instances information is given of the generating plant installed. Indices to names, power stations and places make reference a simple matter in this extremely useful annual. Published by Benn Brothers Ltd. 582 pages, 7¼ in. by 5¼ in. Price 30s.

B.B.C. Handbook

A COMPLETE change has taken place in this 1955 edition of the Corporation's annual publication. Gone are the articles by broadcasting artists and many other features which were intended to interest the listener and viewer, and in its place is a clear guide to the working of the B.B.C. It commences with notes on the constitution of the B.B.C., and the broadcasting services, both home and overseas, with a general outline of the work of the various departments in arranging the programmes. In addition to listing the names of the principal members of the staff, this handy volume includes a copy of the last balance sheet and such data as an analysis of programme output, and a list of operatic broadcasts. Much of the information will be welcomed by those professionally interested in broadcasting. Published by the B.B.C. 224 pages, 3¾ in. by 5¾ in. Price 5s.

Industrial Electronics

by R. Kretzmann.

WHEN the power engineer wishes to teach himself something of the development of electronics, he is likely to experience difficulty in finding a book to suit his needs. There are whole libraries of textbooks with a strong admixture of mathematics, suitable for college courses, and a goodly selection of the popular science type of volume. Books that will take his basic electrical knowledge for granted, and embark on a discussion of the "bricks" of industrial electronic gear are less plentiful, and so the present volume is a welcome addition to an otherwise overfull field. It devotes but one-third of its length to a description of valves and the associated basic circuits, and thereafter deals with specific circuits and apparatus. In this way are covered relays and counting circuits, timers, rectifiers, motor and welding controls, h.f. heating and several other topics. General information on electronic techniques is conveyed incidentally to the detailed descriptions: it is none the less effective for that. There is the disadvantage that the author necessarily treats mainly of one manufacturer's practices, but this is a comparatively minor fault in a book of this nature. Published by Cleaver-Hume Press Ltd. for Philips Technical Library. 236 pages, 9 in. by 6 in. Price 25s.

BOOKS RECEIVED

Acoustics, by L. L. Beranek. Designed for engineer or scientist practising modern acoustics in the laboratory or in the field. Published by McGraw-Hill, 481 pages, 9 in. by 6 in. Price 64s.

Electric Power Stations, Vol. 1, by T. H. Carr. New addition includes further information added to nearly all sections providing a comprehensive volume for the engineer and student alike. Fourth edition, published by Chapman and Hall, 605 pages, 8½ in. by 5½ in. Price 70s.

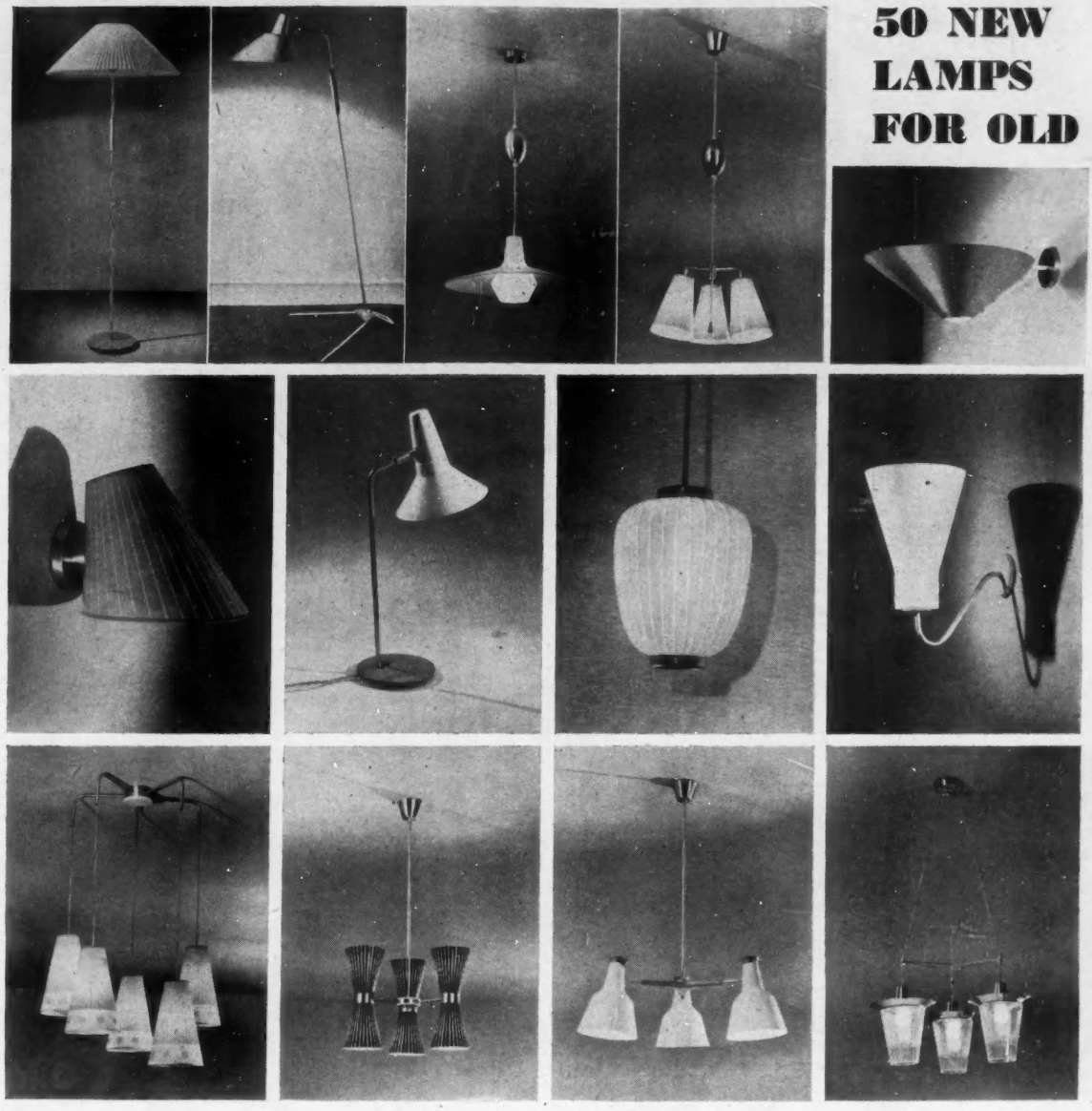
The Repair of the Small Electric Motor, by K. Wilkinson. Straightforwardly sets out the practical aspects of maintaining and overhauling motors up to 1 h.p., covering both domestic and industrial machines. Published by Spon, 180 pages, 8½ in. by 5½ in. Price 20s.

Electric Traction, by A. T. Dover. Standard work, thoroughly revised and largely rewritten, bringing subject matter up to date to provide a useful reference book for engineers and advanced students. Third edition, published by Pitman, 441 pages, 9 in. by 6 in. Price 60s.

Some Aspects of Industrial Noise and Vibration Measurements, by A. E. Cawkell. Designed primarily for industrial engineers, discussing necessity of noise and vibration measurements in industry and fundamental principles of sound radiation, with reference to equipment available. Published by A. E. Cawkell, Electronic Engineers, 6-7 Victory Arcade, Southall, Middx., 34 pages, 8 in. by 5 in. Gratis.

Automobile Electrical Maintenance, by A. W. Judge. Comprehensive guide for service engineers and private motorists, giving detailed accounts of components and accessories, with considerable revision and new material. Third edition, published by Pitman, 256 pages, 7¼ in. by 4¾ in. Price 12s. 6d.

50 NEW LAMPS FOR OLD



THIRTEEN EXAMPLES FROM THE NEW GEC CONTEMPORARY RANGE

Reading from top left to bottom right of these new fittings from the G.E.C.s new contemporary range are first the F39009 floor standard with shaft of satin brass with wood grip and base, and pleated buckram shade in champagne, cherry red or light blue, then there is F39008 a "giraffe" floor standard for reading. It has a satin brass shaft, dove grey legs and mustard yellow or cherry reflector. This F30072 rise or fall fitting is available with rod pendant (F40110). It has silk screened card shade of red with white lines supported on a white flash opal glass, the fourth design, F34051, has shades of red card with white lines. The one light bracket on the right, F32081, has a satin brass conical reflector with white opal glass cup which can be removed for cleaning without disturbing the wiring. On the second row—the first wall bracket, F32085, is most inexpensive and has silk screened card in red or yellow with white stripes. It can be turned in any direction. The desk standard, F38053, has a polished wood base, satin brass stem with adjustable ball joint and aluminium shade in black, white and cherry. F30062 is a pendant for one 200 W lamp and has thin clear stripes on the white glass bowl to give sparkle. The pendant of satin brass has a spring inside the monk's cap which automatically lifts it clear of the glass for cleaning when locking screw is released. Another wall bracket, F40118, incorporates flashed opal glass and satin brass metal work. On the bottom row—the first fitting, F34043, incorporates G.E.C.'s novel suspension for a number of shades hanging from a single point. The white twin-core cable, which is used in the range, can be altered in length to suit individual taste. The shades are cherry card with white skirt and star motif pierced to add sparkle. Those diabolas in black and white or red and white feature in a number of designs. In this fitting, F34048, they are held by a specially-designed centre piece which is also available as a five-light fitting. Another method of suspension is employed in this fitting, F34045, which has black, white or peony red reflectors with polished brass crowns held on a satin brass suspension with neutral grey wooden ornament. A third type of suspension is used in the final fitting which employs a satin brass spreader to the white p.v.c. flexibles holding in this case (F30063) lanterns with polished brass tops and clear glasses with fine line decoration. In this fitting 60 W Silverlight lamps are used to form part of the decorative effect. The main feature of this new range apart from the clever attractive design is the ease of installation and the infinite variation in make up of the fittings using different suspension methods and different shades or reflectors and combinations of colours.

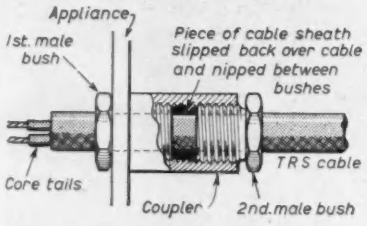
PROBLEMS AND PRACTICE

In Engineering

Every engineer has a story to tell; why not tell yours on this page? We welcome contributions to this feature, and those published will be paid for at our standard rates. Problems which are encountered and overcome in day-to-day maintenance or installation of electrical plant; useful methods and techniques developed for specific jobs, or current practices, all make instructive reading for others. We will also consider for publication problems requiring an answer. Sketches are often helpful and need only be rough, as they will be redrawn before use.

Emergency Cable Grip

MAINTENANCE engineers are faced, from time to time, with urgent plant commissioning involving a temporary installation, often hooked up more with an eye to getting plant quickly into service than to complying with particular regulations. For this purpose bunched v.r.i. cables, often tied to nails with string, look most untidy whilst the entry into switch or motor, due to lack of proper anchorage, is always a source of danger. For these reasons, the use of multi-cored t.r. or p.v.c. sheathed flexible cable is recommended as offering a neater appearance, better protection from mechanical damage and, by using suitable



Use of an ordinary conduit coupler and a pair of bushes to provide a cable grip

cable grips, a sound termination at a cable entry, to say nothing of the speed with which such cable can be run compared with measuring off v.r.i. cable, cutting it to length, and finally bunching and lashing.

To add to the difficulties of the maintenance engineer when urgently called upon to install such cables, it is not unusual to find that his department has run out of proper cable clips (particularly so at remote sites as evidenced by the number of horrible examples of flexible cable entries to be seen). When such a situation arises, I find that an efficient substitute can be made from a conduit coupler and two male conduit bushes, sufficiently large in size to just slip over the cable sheath.

The coupler is secured to the terminal box with one of the bushes, as shown. The other is slipped over the cable, which is then pushed through the coupler into the terminal box. To ensure that the cable is firmly held in position, a small strip of sheathing is wrapped round the cable before insertion. When the second bush is tightened, this strip is compressed between the two bushes, thus pushing it inwards to grip the cable.

It should be remembered, however, that temporary installations suffer from the danger, unless a close watch is kept, of becoming permanent, and it is therefore necessary to emphasise compliance with I.E.E. Regs. 501-510. Particular attention should be paid to Reg. 507, and, if after three months the temporary work is still in service, the responsible person should have cogent reasons for not making it permanent, and prominent display of his name should be made to serve as a reminder of his responsibility in this respect.—*T. H. Snelson.*

Wiring Techniques

I READ with interest the articles in the issues dated Sept. 17 and Sept. 24 respectively, by Mr Satchwill. Referring to his first article, concerning installations in hollow floors, a piece of conduit with two square bends requires a rather large hole to pass through a hollow floor, whichever way it is inserted, either from above or from the ceiling side. Moreover, I imagine the box has to be welded to conduit when in final position, though I cannot imagine any reputable electrical contractor or his representative permitting the arrangement or the time. Furthermore a fitting of any weight suspended from the box would spring the extension piece away from the box lid, which has now become the bottom of the box and presumably secured by screws to the tile itself.

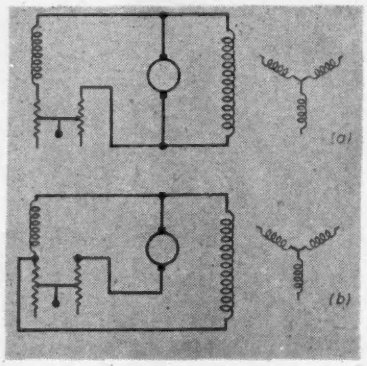
On his second article, I would point out that it is standard practice, in cases where a running coupler is required near a conduit box and where conduits are reduced from one size to another, to use the reducer as a running coupler locked securely by a solid lock-nut, the reduced size conduit entering the spout to give greater strength at the joint. In the illustration, one reducer only is required and I see no reason why a ¾ in. box is necessary with the same size conduit leaving identical spouts.—*W. H. Williams.*

Demagnetised Alternator

A ROTATING armature 10 kVA alternator, fitted with vibrating contact automatic voltage regulator was sometimes found to go "dead" immediately after it had run up to approximately full speed on starting. Examination showed that all the connections were intact, but the exciter was completely demagnetised. Whilst the usual circuit is shown in Fig. 1, this machine was connected as Fig. 2.

The sequence of events on starting which explain the above phenomenon would appear to be that initially there is no voltage across the exciter armature, and the field rheostat is short-circuited by the a.v.r. As the machine accelerates, a voltage is generated which rises to something above the normal running value, probably about 2½% but depending on the setting of the a.v.r., and when this comes into operation resistance is inserted in the field circuit. Now the alternator field, especially as the machine in question has a rotating armature in a d.c. type of frame, has a very high inductance. When the exciter voltage drops due to the insertion of resistance into its field, this inductance will make the main current continue to flow. With the normal connections as in (*a*) this surge will pass through the exciter armature, whose impedance is low, rather than through the parallel path through the rheostat and exciter field. With connections as in (*b*), however, conditions are different, and the surge will divide between two alternative paths, one through the rheostat and exciter armature, and the second through the exciter field. If sufficient current follows the latter route, the exciter will become demagnetised which, of course, was happening.

The reason for adopting the unusual connection would appear to be to enable the manufacturers to make use of an exciter which was too large, and thus gave the correct current at too high a



The incorrectly wired regulator is shown in (b) with (a) giving the normal connections.

voltage for the alternator in question. The alternative arrangement of inserting a separate resistance in series with the alternator field in the normal circuit had the possible disadvantage that it reduced the sensitivity of the system so that changes in the exciter field current had insufficient effect on the output voltage to render the a.v.r. effective. The only certain remedy would appear to be to obtain and fit an exciter of the correct output.—*J. Mellanby.*

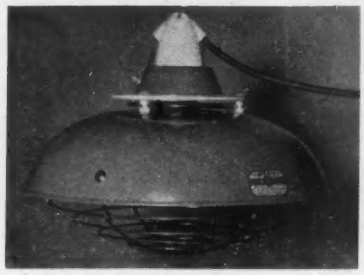
Electricity in Dairying

MODERN METHODS SHOWN AT OLYMPIA

GREAT event in the dairy farmers year, the Dairy Show, which has just finished at Olympia, was even more successful than before to judge from the volume of orders and enquiries received.

Electric Vehicles

The unique value of the electric vehicle is obviously more appreciated by dairymen, for most of the electric vehicle manufacturers reported full order books. Helec's Vehicles had by the second day of the show secured 22 orders, mainly for their "Help Mate" one-tonner vehicle, whilst Morrison Electricars were very pleased with the situation. They were



This is the new "Major" brooder by L. A. Wrenn

getting many enquiries, the two new models displayed being an obvious draw. First of these was a new 20-cwt junior version of the ED25 known as the D4. It is similar in design to the ED25. With "walk in" driver's cab, excellent manoeuvrability and easy maintenance (batteries accessible through middle panel of load floor) the D4 will be popular with operators. Second was the ED25 making its Dairy Show debut.

Smiths Delivery Vehicles, showing a 30-cwt dairy truck and the new model "Percheron" 3-wheel vehicle chassis reported capacity working even though their factory has recently been extended by another 6,000 sq ft. The 30-cwt truck is fitted with the "Checklite" warning system.

Wales and Edwards, who feature one basic chassis with different-sized motors and batteries, reported good business, whilst Diamond Motors were satisfied with their orders. Incidentally, they featured a new Graiseley relay tester to check the operation of the time voltage relay in chargers.

Batteries for powering these vehicles were featured both by The D.P. Battery Co. and by Tudor Accumulators. The former had a wide selection of "Kathanode" batteries for delivery vehicles and dairy works platform trucks and a number of D.P. stationary batteries. Main Tudor exhibits were a number designed specifically to withstand the arduous nature of a seven-day week milk service. They were shown together with open and sealed cells for farm lighting and power.

Westinghouse Brake and Signal Co. have made a feature of their VZ chargers shown in each of three frame sizes for use with P.C.V.'s driver-type milk floats and fork lift trucks.

So much for the distribution of the principal end product of this industry but electricity "shines brightly" in the production stages of the industry.

Power Units

From the fodder preparation machinery through milking equipment to bottling and packing equipment the electric motor was well in evidence. Typical of these motors were those shown at the "Sign of the Gryphon," by Brook Motors. Gryphon motors from ¼ to 1 h.p. in drip-proof totally enclosed or fan-cooled types are supplied with or without feet or flange or resilient mounting. The smaller fractional motors B.S. 42 from 1/16 to 1/3 h.p. are made for standard, flange or face mounting. An effective

The Helec's Help Mate is a best seller for dairy work

display on this stand was the 1¼ h.p. motor running amid a dust storm in a glass casing. An attractive wall display showed a telling comparison between the old 20 g.p.h. method of raising a water bucket at the well and using a small electric motor giving 350 g.p.h.

R. A. Lister cater principally for the farmer without mains supplies in pumping and power supply. Featured on the stand were stock clipping and shearing machines and for the dairy itself electric cream separators, "Inchurn" and "T.T. Streamline" milk coolers and various utensils. Geo. W. King's exhibit at a show like this naturally featured the farm building and constructional equipment for which they are noted. They featured as well examples of their electric hoists.

The Complete Dairy

Presenting an overall picture of "Mr Amp" at work in the dairy E.D.A.'s stand showed equipment for farmers with 20 head and larger farms with 40 head of cattle. This was broken down into 4 sections (*a*) for the 20 cow herd using direct milking, (*b*) using bucket milking, (*c*) for the 40 cow herd using direct to churn, and (*d*) using bucket milking. Running costs amounting to 2 1/5 d. per cow per day, 2 1/10d., 1 1/5d. and 1 3/10d. respectively were prominently displayed. Also shown were electric block storage and element-type steam raisers and steriliser chests, farm water heaters and chilled water milk coolers to cover the requirements for each method of milking. Interesting feature was the 1 in. to 1 ft scale model of an all-electric dairy.

Folding

Shown by the Wolseley Sheep Shearing Machine Co., Ltd., amongst their "turbulent coolers," bucket heaters and bucket milk coolers was an item of equipment intended principally for the sheep farmer but of interest to anyone concerned with livestock. This was Wolseleys Royal Show prize-winning equipment which comprises entirely new corner straining posts to which are fitted special insulators allowing the wire to run freely through them without becoming detached. Another new item was the Pocket Line tester, designed so that the farmer can gauge the strength of shock.

Poultry

Poultry produce is an important facet of dairying and much space is devoted to this subject. L. A. Wrenn and Co. have featured many models of their Wren infra-red dull emitters especially designed for the scientific rearing of chicks, piglets, ducklings and turkey poults. Curfew Appliances had an exhibit attracting attention with chicks actually hatching in the incubators. Visichick have a new line in electric greenhouse heater and humidifier.

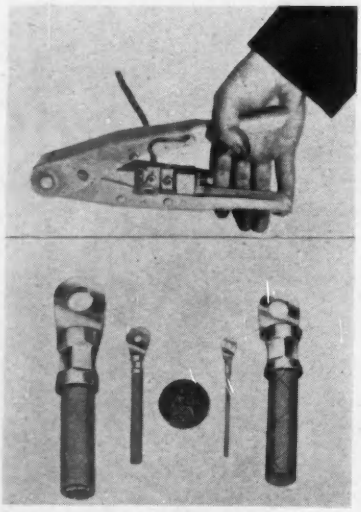
E.D.A.'s stand showed equipment for a 20 cow herd using direct to churn milking. It included sterilising chest, water heater and rotor freeze and water cooler

Equipment for Industry

Solderless Wiring Connection

WITH the increasing use of aluminium for conductors, difficulties experienced with soldered joints have created a demand for developing methods of jointing which eliminate conventional soldering techniques. THE PLESSEY CO., LTD., Ilford, Essex, have developed a method which relies on mechanical action only and takes the form of a crimp. Originally developed for the aircaft industry, the system is now to be extended to a much wider field of industrial application, being especially suited to use in coal mines and oil refineries where naked flames, as employed for soldering, might be hazardous.

Two kinds of crimp have been produced, relying on either indentation or hexagonal swaging. In the first, the solderless wiring connection is made by manually crimping opposite sides of a connection tag until the wire conductor is gripped immovably. A tool similar in design to pliers, is used for this operation. For hexagonal crimping, the above method may be used with the aid of suitable dies, or if larger cables are employed a foot-operated hydraulic tool is available. This allows cables of capacity up to 280 A to be jointed; 200 A if aluminium.



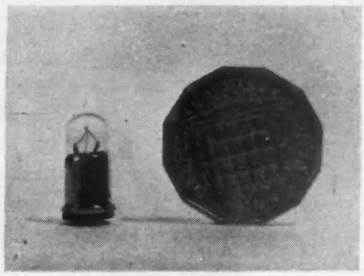
Above : the hand-crimping tool is seen in action. Examples of hexagonal crimped terminal connections below

A cross-section of sample cable having a multi-strand conductor demonstrates that after crimping, good all round contact is made. Cable terminations for both indentation and hexagonal crimp are being produced, and in the case of the latter the whole of the "Pren" and "Prenal" range of fire-resistant aircraft cables has been catered for.

Tiny Atlas lamp

IN view of the increasing trends towards sub-miniaturisation in equipment it is interesting to learn that THORN ELECTRICAL INDUSTRIES LTD., 105-109 Judd St, W.C.1, have developed the Atlas Pea lamp primarily for use in the Thorn "Plasteck" system of internally illuminated aircraft control panels.

Type approval has been granted by the Royal Aeronautical Establishment at Farnborough for this Atlas Pea lamp rated at 28 V 0·04 amp. Its overall length is 14·6 mm. with a bulb diameter of 6·3 mm. There are very many obvious applications for these lamps in aircraft, marine craft, motors, electronic and radio equipment, particularly as we understand that in addition to the above, 12 V, 6 V and 1·5 V ratings have been already developed for the Signals and Radar Development Establishment. The lamp has a flanged cap with a single centre contact so that it can be fitted even more easily than the normal indicator lamp. A range of miniature sealed lampholders has also been developed.



The lamp is seen here compared in size with a threepenny piece

Sleeving for shafts

AN ideal form of covering for rods, tubes and bars, is the claim made by LACRINOID PRODUCTS LTD., Gidea Park, Essex, for their special p.v.c. sleeving known as "Vietum." Already being used for a variety of purposes, the material has all the qualities of p.v.c., being resistant to oil, spirit, acid and alkali alike. Normally in the form of tubing, it may also be supplied in short lengths suitable for covering pliers handles; in this case one end is blanked-off. Heating the "Vietum" effects shrinkage of between 30 to 40% in diameter and 10 to 20% in length, by this means a tight fitting cover is obtained, this moulds itself to the shape of the equipment so covered. Available in various colours, "Vietum" may also be supplied with different types of decorative ribbing or plain as required.

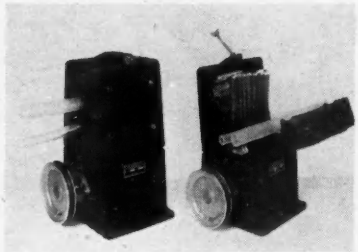
Vacuum Counting Valve

FOR use in all normal batching and counting operations, a new high-speed decade counter tube, type "E.1.T.," is also suitable for high-speed computing, telecommunications and radiation counters. This tube, of the hard vacuum type, is claimed to be capable of a higher counting rate than cold-cathode gas-filled decade counters, its value is said to be only limited by associated circuitry and normal counts of 30,000/sec. are to be expected. MULLARD LTD., Century House, Shaftesbury Ave, W.C.2, are the makers.

Squeeze-pump now available

READERS of our monthly feature, "From an Engineer's Notebook," will recall the reference (5 Aug. issue) to a pump used to simulate the action of the heart, in which the blood was motivated by a roller squeezing it round a loop of plastic tubing. This principle of operation is also employed in a pump recently made available on the British market by V. A. HOWE AND CO., 23 Pembridge Rd, W.11. Of American manufacture, the pump goes under the name of "Sigmamotor," and is particularly suitable for laboratory or process work where corrosive liquids, slurries or gases require to be handled.

It differs from the "heart pump" in that the fluid being handled is squeezed along a straight length of tubing by the action of a series of cam-operated fingers each pressing against the tubing in turn, to impart a positive uni-directional flow in it. Several lengths of tubing may be incorporated in the pump to create a flow in a number of completely isolated fluid systems. No valves are required as the fingers ensure that the tubing is always closed at at least one position during the cycle. Two basic models are available, the T-4 covering a range of 275 galls/hr to 10 galls/hr, and the T-6, ranging from 30 galls/hr down to 5 c.c./min.



Here is seen the T-4 "Sigmamotor" pump in both open and closed positions

Plant irradiation for the amateur

LATEST "Sieray" irradiation unit introduced by SIEMENS ELECTRIC LAMPS AND SUPPLIES LTD., 38-39 Upper Thames St, E.C.4, brings plant irradiation within the means of everyone.

Plant irradiation for 79s. 6d.

This Sieray unit is a special parabolic low intensity lamp with internally-silvered reflector and a "solar spectrum balanced" light source of mercury vapour discharge with a tungsten filament lamp. It operates direct from the normal 200/250 V mains without any control gear, the lamp being rated 200 W. Reflectors are unnecessary; one unit suspended 2 ft above soil level covers 4 sq ft.

A special porcelain lampholder complete with suspension link and protected cable entry ensures safety from shock and makes the complete unit light enough to be suspended from the greenhouse frame without straining it.

As the average life of one of these lamps is 2,000 hours this means virtually one year's trouble-free operation invaluable to the horticulturalist at a low figure of 79s. 6d. (tax free).

Price Changes

AS from 1 Nov. the prices of the Mazda single and twin lamp 5 ft open-ended "Perspex" fluorescent reflector fittings will be reduced to the following: Single lamp fitting £8. 8s. Twin lamp fitting £10. 8s. 8d., according to BRITISH THOMSON HOUSTON CO., LTD., Crown Hse, Aldwych, W.C.2.

Also from 1 Nov. prices of certain products of CHILTON ELECTRIC PRODUCTS LTD., Hungerford, Berks, have been increased.

The Dual Voltage KUB shaver has been increased from £4. 10s. 5d. to £4. 15s. (including p. tax), an increase of 4s. 7d. The price of the Universal shaver socket type 1 with fuse protection only is also increased by 5s. 3d. from 39s. 9d. to 45s.

Self Fluxing Enamelled Wires

TWO new products developed by LONDON ELECTRIC WIRE CO. AND SMITHS LTD., Church Rd, Leyton, E.10, meet a demand for an enamelled wire which can be soldered or dip tinned without prior removal of the insulating film.

It has been found that whilst it is relatively simple to produce an enamel which will act as a flux when the wire is dipped in solder or heated, such enamels have poor mechanical properties and are less resistant to varnish solvents.

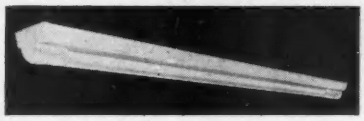
In the new types this is overcome. "Lewcosol" recommended for the winding of unimpregnated coils where maximum solderability is desired, is based on two synthetic resins which whilst thermoplastic at the required temperature show little plastic flow beforehand. The ends of Lewcosol wire can be twisted together and tinned with a soldering iron without any attempt to remove the enamel. To start with Lewcosol will be offered in two grades of enamel thickness equivalent to F. and M. grades of BS 1844 over the size range ·002 to ·056 in.

"Lewtinex" wires represent a modified form of "Lewmex" which whilst retaining all the properties of "Lewmex" also have self fluxing properties. They will not readily solder with an iron, but will dip tin on molten solder at 475° C. These wires are being offered initially in the range of round wires between ·024 and ·080 in. with "M," "T" and "X" grades of covering.

Ekco's new slim batten fitting

CURRENTLY advertised in this issue is the new 80 W 5 ft slim batten fitting announced by EKCO-ENSIGN ELECTRIC LTD., 45 Essex St, W.C.2, to sell at £4. 4s. Designed for direct fixing to ceiling or suspension this fitting fills a demand for an inexpensive, good-quality fitting. Features include its modern slim design, simple installation, high-quality tapped control gear, entirely new design of low loss, first quality high gloss white stoved enamel and individually packed in cartons.

The new Ekco fitting



New Thermovent Watertight Thermostat

THE Thermovent range of thermostats has now been extended by the introduction of a new watertight model (Type WT/45) which provides economic operation of electrical space heating installations where dampness, water spray or rough treatment preclude the use of standard type thermostats.

Particularly suitable for use in greenhouses the Thermovent Thermostat Type WT/45 is manufactured by E. K. COLE LTD., Ekco Works, Southend-on-Sea, and is for operation on a.c. supplies. It has a temperature range of 35°—70° F and, with suitable heating equipment properly disposed, will control temperature to a differential of ±1° F. An accelerator is employed on loads up to 8 amps, thus improving the general operation and ensuring efficient control on light loads consistent with that obtained on heavier loadings.

Finished in matt black, the thermostat zinc alloy case has ¾ in. screwed spout entry top and bottom, a sealing plug blanking the unused entry. Integral buttressed lugs are provided for easy mounting. Voltage: Maximum 250 V. Load: Maximum 15 amps. Dimensions (overall): 6¾ in. by 4¾ in. over fixing lugs by 2 7/8 in. deep. Price: £3. 15s. (tax free).

For the Electrical Trade

Flash proof floor cleaners

A RANGE of flash and explosion proof floor cleaning machines has been developed by COLUMBUS DIXON LTD., of Capitol Works, Wembley, for use in dangerous locations.

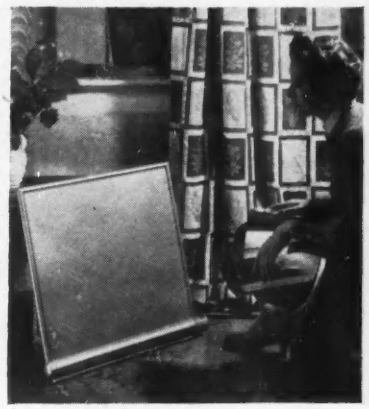
The flash proof motor is operated by compressed air of 80-100 lb p.s.i. and 30 c.f. per minute air flow. Otherwise it is similar in performance and appearance to the Senior Dixon Floor Machine.

Erratum

IN our note concerning Simplex cooker control units in our last issue the third paragraph should read: "These control units are finished in cream or white and can be supplied with rewireable or cartridge fuses at the same price." We regret the unfortunate misprint.

The Stylish "Rem" for good sales

ANOTHER product from the ex-service man's organisation REMPLOY LTD., 25 Buckingham Gate, S.W.1, which is a good line is the Rem oil-filled electric radiator. Safe and portable the Rem comes in two sizes, model MH 5/2, ½ kW at £8. 10s. plus £3. 2s. 2d. purchase tax, and model MH 5/1 ¾ kW at £9. 5s. plus £3. 7s. 8d. purchase tax. Both models are finished in hammered beige and are supplied with 6 ft of 3-core flexible cable.



Comfort and style from the Rem

NEWS OF THE WEEK

Scottish Electricity Bill in the Lords

THE Electricity Reorganisation (Scotland) Bill has almost completed its passage through both Houses of Parliament. It was passed through the Committee stage without amendment in the House of Lords last Thursday. Under the Bill the functions of the Minister of Fuel and Power as they relate to electricity supply in Scotland will be transferred to the Secretary of State for Scotland, and a new authority, to be known as the South of Scotland Electricity Board will be established.

Trade Boom has come to the Electrical Industry

DELIVERY DATES EXTENDING AS MANUFACTURERS STRIVE TO KEEP PACE WITH HUGE DEMAND

DEMAND for domestic electrical appliances is attaining all-time records, and the simple fact disclosed by enquiries in the past week is that production cannot keep pace with the buying spree. This situation has developed in spite of high production rates at most of Britain's factories. The larger wholesalers hold fair stocks at the moment, but delivery dates are extending and there is no guarantee that these stocks can be easily replaced. One prominent wholesaler said there were indications of a shortage, and it was possible that many goods will be in short supply in two or three months' time. Another, more cautiously, commented that demand was well above seasonal level. Smaller wholesalers are finding the going very difficult. Supplies from manufacturers have been cut, delivery may be anything up to three or four months after placing the order, and it is impossible to satisfy all customers. Comments from manufacturers concerned describe the present demand in such terms as "fantastic," "phenomenal," "overwhelming," and "embarrassing."

The main item concerned in the boom is the electric fire, followed by radiators, cookers, kettles, hair-dryers, irons and vacuum cleaners, and extending to switches, switch sockets and lamp holders. The apparent shortage does not, of course, extend to all types of these appliances, but limitation in any one type is inevitably felt in the overall supply position.

The reason for the boom in fires is not difficult to discover. Not many months ago a great deal of attention was drawn to a possible shortage of coal this winter—anxiety being expressed in Parliament by the Minister of Fuel and Power, and given a great deal of publicity. To guard against a possible repetition of the 1947 crisis, the public has turned to electricity. Added to this, the B.E.A. and Area Boards have been allowed to conduct promotional advertising in the past year or more, following many years of "demotional" publicity, when warnings about peak hours and the like were prevalent. Manufacturers, too, have been advertising to no small extent. All this has led to a greater reliance on electricity and on the electric space heater in particular. Another contributory reason for this exceptional demand is the tremendous increase in building—particularly houses. Figures in this field are setting post-war records and the consequent requests for domestic appliances are now being felt. More faith in the supply industry and the absence of power cuts has, inevitably, led to the purchase of more electrical "accessories" and smaller appliances.

Manufacturers are embarrassed by the situation. A well-known company making fires and cookers said they were overwhelmed. They built up a large stock in the summer and expected a lull later, but demand has continued with no abatement. A manufacturer of fires, lighting fittings and water heaters stated the situation was almost beyond control—deliveries were about three months behindhand. Another said there were so many orders outstanding that only one in four appliances asked for could be supplied. In a few cases, shortages of semi-skilled labour and of materials are given as secondary causes for the present boom, but the main reason is simply that consumers want more than can be made.

A.E.I.-Thompson's Atomic Link

ASSOCIATED Electrical Industries Ltd. have entered into an association with John Thompson Ltd. with a view to carrying out preliminary studies in the application of nuclear energy for industrial purposes. A strong team has been formed consisting of mechanical, electrical and civil engineers, physicists and metallurgists from M.V. and B.T.H.—the A.E.I. companies principally concerned—and John Thompson's. Leader of the team is Mr S. A. Ghalib, formerly assistant chief engineer, Electronic Control Dept., M.V. The team will work in close co-operation with the U.K. Atomic Energy Authority. It will start work in about two months' time at headquarters in a new building near Manchester.

Reprieve granted to Government Censuses of Production and Distribution

RESULTS of the inquiry into the usefulness of the Censuses of Production and Distribution have been published as a White Paper. A committee of 14 under the chairmanship of Sir W. Reginald Verdon Smith was appointed by the President of the Board of Trade to advise him on future policy, following criticism, mainly by the Association of British Chambers of Commerce. The committee examined the various purposes to which the censuses were put and have concluded that they do serve a useful purpose and should be continued.

They recommend that full censuses of production should be carried out in 1957 and 1961, and that a sample census should be taken each year that a full census is not. They also suggest that the possibility of extending the period between full censuses to five years should be considered not later than 1960, in the light of further experience of sample surveys. Employment of 25 persons and not 11 should be regarded as the basis for asking firms for returns. Consideration should also be given to simplifying the completion of forms and to the possibility of reducing the price of the census report. As regards the census of distribution it is recommended that this should be taken every 10 years and in the intervening time sample surveys should be undertaken every third or fourth year.

Holiday Pay for Strikers?

ELECTRICIANS employed in the lighting department of Edinburgh Corporation have applied for two days' spring holiday pay. This holiday is a local one. The claimants maintain that they lost the money when they went on strike earlier this year. The request was rejected by 13 votes to six. Clr. Wynham Miller described the request as the most amazing thing he had ever heard about any strike. The application was fantastic, he said.

Floor Heating in Glasgow's 10-Storey Blocks of Flats

THERE is more news this week of the adoption of electrical floor-heating for large blocks of dwellings. The system is to be installed in two blocks of flats forming part of the Toryglen housing scheme undertaken in Glasgow by the Scottish Special Housing Association. Each tenant in the 10-storey 80-flat blocks will have individual control of temperatures and consumption through preset thermostatic control. This installation of embedded floor-warming has been designed by Panelec (Great Britain) Ltd., and has a connected load of 253 kW. Successful operation in these flats will be followed by an extension of the system in eleven other blocks in the same area.

The adoption of floor-heating, elements embedded in the floors of premises, in multi-storey flats in Glasgow, marks a further stage in the development and use of this system. It will be recalled that considerable research in Inverness resulted in what was probably one of the first uses of this method of heating in private dwellings. Five houses were equipped and it proved successful. As a direct result of this, Kirkcaldy council decided to employ the system when planning a multi-storey block of flats. In addition, this means of heating has been employed successfully in a number of other buildings up and down the country.

Travellers' Dinner

MIDLAND branch of the Electrical Trades Commercial Travellers' Association will be holding their annual dinner at the Queen's Hotel in Birmingham, on 12 Nov. Principal guest will be Mr E. L. Russell, Birmingham's Education Officer.

OFFICIAL PUBLICATIONS

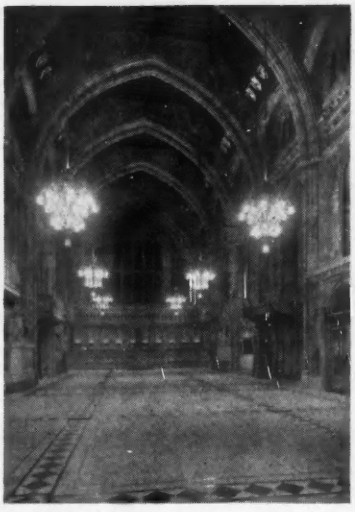
BRITISH STANDARD

R.1., 1954: Sizes and Forms of Civil Aircraft Radio Equipment. Available from BSI 2 Park St, W.1.

STATEMENT OF GUARANTEE issued by Treasury in respect of temporary borrowings by the B.E.A. (see page 683) H.M.S.O. 2d.

GUILDHALL CHANDELIERS

The reconstructed banqueting hall at the Guildhall, London, was officially "opened" at a little ceremony last Monday. The old timber roof was destroyed by fire during the war and has been replaced by a steel roof clad in timber. From this now hang eight bronze lighting fittings, each weighing about 10 cwt and measuring 8½ ft in height. They were made at the Magnet works, Birmingham, of the G.E.C. Main lighting is by 25 200 W lamps, of which there are 16 in the upper tier, eight in the lower tier, and one in a decorative finish at the bottom of the fitting. Concealed lighting from four 60 W lamps at the top of the fitting is arranged to illuminate the ceiling. Architect was Sir Giles Gilbert Scott. Installation was carried out by Alliance Electrical Co., Ltd.



Gloucestershire to be told about Electricity

A THREE-DAY exhibition and conference on electricity in housing is to be held at the Town Hall, Cheltenham, next week. It is being organized by the Midlands Electricity Board who have invited representatives of local authorities, architects, builders, electrical contractors, public health and education officers, and others in Gloucestershire to study the contribution which electricity can make to the solution of housing and other problems. At the conference sessions, Mr A. L. Osborne will speak on Electricity in Housing, Mr A. F. S. Wright on Electric Floor Warming, and Mr Basil Z. de Ferranti on the heat pump.

The exhibition will be open to the public on all three days of the function, 9, 10 and 11 Nov. Included in displays will be equipment for cooking, space and water heating, laundry and refrigeration, street lighting, catering and public health. Special displays of power tools and lighting will also be prominent.

Advertising signs of British exporting firms are well in evidence in cities overseas. This latest sign, for Smiths English Clocks Ltd., has been added to the lights of Stockholm. This company incidentally now exports to 97 different countries

Physical Society's 1955 Instrument Exhibition

NEXT year's exhibition of scientific instruments organised by the Physical Society will take place in the New Hall of the Royal Horticultural Society, Westminster, between 25 and 28 April. Hitherto, the exhibition has been held at Imperial College, but the change of venue will not mean a change in character. Space in the New Hall is more compact and it is hoped that visitors will now be able to see the exhibition more advantageously in a shorter time. Arrangements for the 1955 display are now well in hand, and it is expected that about 140 exhibitors will participate. Exhibits will include scientific instruments and apparatus newly developed or in the process of development and pieces of research apparatus which make use of physical principles in ways hitherto unexplored.

1899 Act said to be Delaying Power Supplies

A CLAUSE in the Electricity Act of 1899 was said at a meeting of the S.E. Electricity Consultative Council to be the cause of delays in the electrification of rural areas in Sussex. The Act provides that anyone within 50 ft of a main can ask to be supplied with electricity without making a capital contribution towards the cost. It was intended to prevent discrimination against prospective small customers. Today however, the Act has different repercussions, the Council allege. Various applications for electrification had been received but the Board found it difficult to comply because of the expense involved, and because some people appeared to delay making a decision so that they could come in later and ask for a supply free of capital cost. An example was given where owners of some properties wanted a supply, but only one was prepared to pay a contribution. It was found impossible to provide electricity without demanding a heavy contribution from that one consumer. The implication, of course, is that the other property owners, could in time receive a supply free.

The matter was referred to in the Council's last annual report, but no satisfactory solution has been arrived at. After discussions between the Area Board Chairman and Central Authority it was decided that an Amendment to the Act might create a worse situation, as might any compulsion in the way of refusing supplies, and that the matter could best be dealt with by tactful handling locally.

Campaign Opened to defend Trolleybuses

A CAMPAIGN against the London Transport Executive's decision to scrap all their trolleybuses and replace them by diesel buses is being organised in the London area. Instigators of the opposition are the London Passengers' Association who are inviting Borough Councils in the area served by the L.T.E. to give their support. Several councils are said to have joined the campaign already, one of the first was Holborn who have decided to refer the matter to the Metropolitan Borough's Standing Joint Committee on the grounds that the displacement of trolleybuses would aggravate air pollution in London. Mr A. J. Pomeroy, the sponsor's chairman, is much encouraged by the quick response to his appeal but hopes it is only the beginning. He feels however that the most important point is one of economics, but the comfort and convenience of the travelling public will not be forgotten.

Railway Reorganisation

A PLAN, of a drastic and exhaustive nature for the re-equipment and modernisation of British Railways is to be presented by the chairman of the British Transport Commission before the end of this year. No details of the contents of this plan have yet been disclosed, but it will undoubtedly involve some degree of electrification. The last annual report of the Commission referred to the wider use of diesel multiple unit sets, and considered that electrification had an advantage mainly in the field of heavy passenger traffic.

New Post-war Exports to Soviet Bloc

MOTORS and alternators destined for the Soviet Union are now being produced by Crompton Parkinson Ltd. This follows the recent relaxation in control of exports to Russia, and it is the first time since the war that the company has had orders for this type of equipment from Eastern Europe. One order received only recently is said to be valued at £200,000. The motors, to be made at the Guiseley (Yorks) works, will be mainly of 2 h.p. rating suitable for machine tool equipment. Alternators are of 512·5 kVA rating for use with diesel power units and will be produced at Chelmsford.

Bexhill will not buy Trolleybuses

TROLLEYBUSES operating within the boundaries of Bexhill are not to be taken over by the Corporation, the town council has decided. The vehicles belong to the Hastings Tramways Co., and Bexhill have the option of purchasing that part of the service within the borough. Main reason for rejecting the trolleybuses appears to be one of finance.

THE MAN BEHIND MULBERRY

PRINCIPAL guest at last week's luncheon of the Batti-Wallahs' Society was Sir Bruce G. White, who chose as his subject "The Engineer in War." Sir Bruce, it may be recalled, was largely responsible for the translation of Sir Winston Churchill's concept of a floating harbour into the reality—Mulberry. In a most amusing talk Sir Bruce described the development of his department in the War Office from himself and two clerks into the vast organisation responsible for the administration and rehabilitation of docks and harbours for military supplies. Mr C. N. Good, President of the Society, introduced Sir Bruce, and Mr Forbes-Jackson proposed the vote of thanks. The next luncheon will be held on Wednesday 24 Nov. when Air Chief Marshal Arthur Longmore will be the principal speaker.

Technical Training Throughout the World

DURING the summer vacation of this year, 564 students of universities and technical colleges went abroad from Great Britain to obtain practical training in overseas industrial concerns. This is stated in the 7th Annual Report of the International Association for the Exchange of Students for Technical Experience. Great Britain received 671 students from other countries participating in the scheme; altogether, the scheme handled exchanges for 4,267 students. Portugal was admitted to the Association during the year, and India and Turkey have now made application for membership. The report states that 75 of the British students who went abroad were studying electrical engineering, while 133 of those coming to this country were similarly engaged.

TRIP TO PARIS IS PRIZE FOR DISPLAY WINNERS

A WEEK-END in Paris for two with all expenses paid, is the first prize in a window display competition being organised by Thor Appliances Ltd. The competition is open to all authorised Thor dealers in the U.K. and is for the display of the company's appliances only. The displays must last for a week at least sometime during October, November and December. Displays will be judged on originality, presentation and sales appeal. Prizes for runners-up will comprise an Automagic clothes washer, a gold wrist watch and cash consolation prizes.

London Store Wins National Display Competition

RESULTS of the window display competition run by Hoover Ltd. during their National Hoover Week last month, were announced last weekend. The first prize of 100 guineas and the national challenge trophy has been awarded to Selfridges Ltd. The prizes will be presented at a luncheon to be held next Tuesday at the Savoy Hotel. As in previous years the competition was divided into three groups, for electricity board showrooms, for departmental stores and home furnishers, and for contractors and ironmongers. Three prizes of 50, 25 and 15 guineas were awarded to successful entrants in each of the three groups.

Window display by Selfridges Ltd., which won the national prize of 100 guineas and challenge trophy in Hoover's window display contest

In group A the prizes went to the Lower Clapton Rd showroom of the London Board, the Barnet service centre of the Eastern Board, and the Eltham showroom of the L.E.B. Selfridges, of course, were the winners in group B, being followed by Bow's Emporium Ltd of Glasgow, and the Southampton store Edwin Jones Ltd. In group C, Willmotts Stores, Norwich, won first place, Baxters of Pontefract second, and Central Merchants Ltd, of Belfast, third place.

Before entries for the national prizes were judged, local prize-winning awards in each of the groups were made in Hoover districts throughout the U.K. District winners were then forwarded to a national panel.

Manpower Problem in Radio Industry

GROWTH of radio and industrial electronics has created a manpower problem in this country and there is now a shortage of engineers and technicians, states the 28th annual report of the British Institution of Radio Engineers. The report stresses the part which can be played by technical institutes in providing the training best suited to the requirements of the industry. Some blame is also credited to qualified radio engineers because suitable authors cannot spare the time to write technical papers and consequently there is a lack of technical information available. Progress in scientific fields is so rapid, the report goes on, that all engineers tend towards specialisation, a tendency not generally appreciated by some educationalists. The Institution maintains that efforts to resist specialisation may have a serious repercussion in arresting development in radio and electronic engineering.

N. OF SCOTLAND BOARD RAISING FURTHER £25m.

IT was revealed on Monday that a further £25m is being raised by the N. of Scotland Hydro-Electric Board. The purpose is mainly to repay temporary advances from Scottish Banks, and to defray further expenditure of building projects and other capital works. On 27 Oct. temporary advances from the banks amounted to some £10,800,000. The new issue is in 3½% Guaranteed stock 1977-80 at par, and carries the Treasury guarantee in respect of principal and interest. This loan will bring the Board's total borrowings up to £107m.

The First Half-Century

This week we publish the final contributions to the discussion on the consumers' lamps together with Mr Wilmshurst's rejoinder. It seems to me that if at any time the consumer required to be educated in the choice and management of his lamps, it would be when he first began to use the electric light, and that when it becomes the usual thing he will know all he wants to know about "lamp efficiencies" just as he is accustomed to acquaint himself with any other detail of domestic economy. At present he is in the school-boy stage, and must have knowledge thrust upon him. Certainly his education should not be left to the private trader or lamp contractor, who has no special inducement to undertake it. On the objections to the sale of lamps by the supply department Mr Wilmshurst touches very lightly. The suggestion of a municipal showroom of electrical apparatus is a good one, if only the public can be induced to frequent the exhibition.—*From our isssue of 3 Nov.*, 1904.

Section of the Birmingham-Wolverhampton Rd at Coseley scheduled to be switched on in about a month's time

Showpiece Street Lighting in the Midlands

MOTORISTS using the 20-mile road between Birmingham and Wolverhampton will shortly be able to enjoy what is claimed to be the best street lighting installation in the country. Only ½ mile within the borough of Dudley remains incomplete. Experts of the Midlands Electricity Board have been working on the scheme since 1948 in co-operation with the Ministry of Transport, local authorities and contractors.

Oldbury completed its section of the road first, installing 200 250 W mercury vapour lamps on concrete columns at 55 lamps per mile. Next came Dudley with similar lamps at 79 per mile. Between these two is Rowley Regis where the same lamps were used but the frequency was again increased to 85 per mile. The installation at Coseley is the particular section of this road claimed to be a showpiece. The scheme covers about 3¼ miles and costs over £20,000. It involves the erection of 340 140 W sodium lamps strung in pairs on steel catenary wires, suspended between 25 ft steel columns and spaced at 105 to the mile. Work is being carried out by the Revo Electric Co., while the Dudley district of MEB is handling cable laying and services. The special lanterns used are so arranged that all light from pairs of 140 W sodium lamps is on the road and none in the driver's eye. These lanterns have been used before in Wolverhampton, but not in pairs on catenary wires.

Commenting on street lighting and the Coseley scheme in particular, recently, Mr T. G. Keeler, manager of MEB's South Staffs and N. Worcs sub-area, said almost all local authorities in the area are adopting progressive street lighting policies and the sub-area had been adding about 1,500 points annually over the past six years. "The Coseley scheme will be a showpiece and lighting authorities throughout Britain are taking an interest in it," he said.

B.E.A. BORROWINGS UP TO END OF 1954

A NEW statement of guarantee has been given by the Treasury in respect of temporary borrowings by the B.E.A. from the Clearing Banks and Scottish Banks or other persons. The guarantee is dated 24 Sept and replaces that given on 28 June last when the figure stood at £130 millions. During the period 1 to 14 Oct the borrowings were guaranteed up to an amount not exceeding £110 millions. For the succeeding part of the current quarter, that is up to 31 Dec, the Treasury guarantee borrowings up to £90 millions.

Electrical Industry meets in Norwich

THE annual get-together over dinner of representatives of the supply industry, contracting industry and E.D.A. of Norfolk, took place at the Royal Hotel in Norwich towards the end of last month. Once again this function was organised by the Norfolk Electrical Social Committee and 150 people attended. Mr W. Sleap, chairman of the local E.C.A., was in the chair, and among the guests was the Lord Mayor of Norwich. There were four toasts, the City of Norwich proposed by Mr T. Wilkes, Norfolk E.D.A.; the Contracting Industry proposed by Mr C. T. Melling, chairman of E.E.B.; the Supply Industry proposed by Mr H. E. Wright, chairman of Ipswich E.C.A.; and the Guests by Mr C. N. Bancroft of Norfolk E.D.A. These were replied to by the Lord Mayor, and Messrs H. A. Greenfield, Norwich E.C.A.; J. A. Sumner, E.E.B. Norfolk sub-area; and H. C. Rowley, Norwich city engineer. Once again the event proved to be highly successful.

New display aid to promote immersion heater sales has been produced by Hotpoint Electric Appliance Co., Ltd. It is being distributed to the trade by the company's branch offices

NEWS IN BRIEF

The E.I.B.A. have published their Year Book for 1954. It contains a report of the previous year, notes and pictures of their Institutions and statement of accounts.

Wembley Town Hall was once again the venue recently for the Annual Ball of the B.T.H. (Willesden) Social and Athletic Club. Well attended, despite the inconvenience of the bus strike, the evening proved to be its usual gay and lively affair.

Glasgow University has received a gift of £5,000 for the development of the Department of Electrical Engineering's work. The gift was made by Mr William Fraser, governing chairman of Scottish Cables Ltd.

An up-to-date list of members has been published in booklet form by the Association of Consulting Engineers.

Full report of proceedings during their 1953-54 session has been published by the Rugby Engineering Society.

Shell Chemicals Ltd., are holding an exhibition on "Epikote Resins and their Uses" at the Criterion, Piccadilly, from 7 to 11 Dec.

On 4 and 5 Nov. the Portland Players are presenting a comedy, "Two Dozen Red Roses" by Kenneth Horne, at the Portcullis Theatre, Monck St, S.W.1. Tickets are obtainable from the Secretary of the Players, B.E.A., Bankside Hse, Sumner St, S.E.1.

Some 1,700 delegates attended the annual conference of the National Housing and Town Planning Council which opened at Scarborough last week. They represented some 600 local authorities and other bodies.

A Sports Lighting Symposium was held at a meeting of the Newcastle centre of I.E.S. yesterday. Leading the Symposium was E.D.A.'s Mr W. Robinson, and among the guests were personalities representing various branches of sport.

Wellington (Shropshire) firm of E. W. Jones (Electrical) Ltd. held a three-day exhibition last week to celebrate their fiftieth anniversary.

Increase for Scottish Contracting Apprentices

WAGE increases to apprentices in the electrical contracting industry in Scotland have been awarded by the Industrial Disputes Tribunal. Resulting from a dispute between the E.T.U. and the E.C.A. of Scotland, the award takes effect immediately. The percentage increases, based on the journeyman's current rate of 3s. 9½d. an hour are: first year of apprenticeship, 25% of journeyman's rate (compared with 20% previously); second year 30% (25%); third year, 45% (35%); fourth year, 55% (50%), and fifth year, 70% (62½%).

Temporary Lighting in 5½ mile N.Z. Tunnel

ALTHOUGH the completed railway tunnel between Warrarapa and Wellington, New Zealand, will not be illuminated, lighting had to be provided for the construction work. Drilling began in August 1951 and was finished this year, and during the whole of that time temporary lighting with fittings capable of being moved when and where they were required while withstanding cordite fumes and dust, were necessary. Equipment used for the project was made by Benjamin Electric Ltd. and consisted of crysteel vitreous enamelled R.L.M. dispersive reflectors and Duoflux floodlights which were continuously in use for nearly three years.

The Rimutaka tunnel is probably one of the world's most remarkable engineering feats. It is 5½ miles long and the two drives from each end were completed with only an half-inch error.

Expansion of Inverness Petroleum Installation

THE Inverness installation of Scottish Oils and Shell-Mex Ltd. has been enlarged and modernised. This was part of a nation-wide plan to streamline the joint system of Shell-Mex and B.P. Ltd, and Scottish Oil and Shell-Mex Ltd., for the distribution of petroleum products. It involves the modernisation of many installations, scrapping of some small and obsolete ones, and the building of new depots. At Inverness the installation has been enlarged and reorganised. Two new pump houses have been built, and there are nine main motor-driven centrifugal pumps in all. The main pumps are remotely controlled by push-button electric switches on the filling gantry and the biggest are capable of filling two large road wagons simultaneously.

QUESTIONS IN PARLIAMENT

Channel Cables

WHAT steps are being taken to prevent cross-channel electric cables from interfering with ships' compasses? asked Capt. Ryder. The Minister of Transport explained that experiments on magnetic disturbances had been carried out by the B.E.A. and others, and the results were being studied. The need to protect compasses would be carefully borne in mind, he said, but Capt Ryder asked if more than that could be done. The Minister assured him that he was well aware of the importance of not interfering with ships' compasses and reminded him that cables could not be laid below high water mark without his permission.

A.E.A. Buildings

RESPONSIBILITY for the erection and maintenance of Atomic Energy Authority's buildings was the subject of questions by Mr G. R. Strauss. Mr N. Birch said that as from 1 Dec., the Authority would assume responsibility for constructional work in the industrial group, and similar arrangements were being made concerning maintenance other than in respect of the London H.Q. The Ministry of Works would continue to cope with building in the research and weapons groups. Mr Strauss was reminded of the fact that all nationalised bodies did their own building, and it would be up to the Atomic Energy Authority entirely the

way in which they carried out their constructional work and whether or not they invited the Ministry of Works to submit estimates.

Factory Inspectorate

THE outstanding claim made earlier in the year on behalf of the Chief Inspector of Factories and his senior staff for an increase in salary, was raised in the House again recently. The claim had been carefully gone into, members were told, but it was not considered that it could be granted. Further discussions were to take place next month.

It was suggested that the attendance of factory inspectors at a course in elementary chemistry, physics and electricity, at the Leicester College of Technology, was evidence of the failure to recruit suitably trained personnel. Members were told that 12 inspectors were attending the course, scheduled to last three terms of 12 weeks. Suggested failure in recruiting was discounted and the questioner was asked if he agreed that the move was in fact an attempt to make the factory inspectorate better trained.

Publicity Expenditure

LAST week Mr H. Hynd drew attention to the big increase in expenditure on publicity during 1953-54 by the Gas Council and B.E.A., and asked what statutory directions had been issued concerning economy. Mr L. W. Joynson-Hicks said that some increase was to be expected following the removal of restrictions on promotional advertising. The Minister was in close consultation with both industries and he was satisfied that responsibility could be left in their hands.

Pollution Report

FINAL report of the Air Pollution Committee was now nearly complete, Mr D. Sandys informed the House last week.

Sayings OF THE WEEK

"More and more has the coal industry come to look upon its role in the future as the supplier of raw material for electricity." . . . DR W. A. MACFARLANE, chief executive of the National Industrial Fuel Efficiency Service, speaking at Manchester last week.

"We are coming to a second Industrial Revolution—we have machines to run machines and we will abolish all of you soon." . . . MR H. C. RUTHERFORD, director of Venesta Ltd., addressing an audience of industrial employers at Brighton Technical College.

"The use of expensive machinery for a 40-hour or 44-hour week is inefficient. Double-shift or even continuous working is sometimes necessary to reduce prices, an absolute necessity if we are to be able to sell efficiently in the export market." . . . MR F. W. HARRISON, president of the Institute of Cost and Works Accountants, speaking at Manchester.

ELECTRIC SUPPLY NEWS

East Midlands

In June, July and August, 6,637 new consumers were connected by the East Midlands Electricity Board in Derbyshire and Nottinghamshire. In addition, supplies were provided to 118 farms.

Middlesbrough

The North Eastern Electricity Board has been in touch with the Town Council regarding the provision of ducts for electrical services in new roads. There is an agreement between the Electricity Board and local authorities whereby the Board supplies ducts to the local councils which the latter place in roads under construction. Local authorities were asked to give reasonable notice to the Board as and when road schemes were to be started, and if the Board did not request ducts to be placed in the roads while they were under construction, the Board had to bear the full cost of breaking up the roads or boring under the road to place ducts or cables therein. The Electricity Board has complained to Middlesbrough Council that outline plans submitted to the Board did not give sufficient detail so that the Board knew where ducts would have to be placed. In these cases the Board had to break up the roads after they had been laid or carry out thrust boring, and it was claimed that the Council should meet the additional cost involved. The board engineer, Mr J. A. Kenyon, stated that every effort was made to supply detailed plans at an early stage, but this could not always be done. The Council has agreed that in future the Board should be reimbursed the additional cost of breaking up roads or carrying out thrust boring where roads had been built without ducts.

North of Scotland

The driving of the five miles long Glascarnoch tunnel, part of the North of Scotland Hydro-Electric Board's Conon Valley Scheme, was completed last Saturday, when Sir Hugh Mackenzie, C.B.E., deputy chairman of the Board, fired the final blasting charge. The Glascarnoch tunnel, which is 10 ft in diameter, will carry water from a new loch formed in the valley of the River Glascarnoch by a dam near Aultguish, Ross-shire, to a 24,000 kW generating station on the shores of Loch Luichart 530 ft below.

We also have news that the Board are carrying out tests to find the best sites for short wave radio stations which will enable their local headquarters to keep in touch with repair and maintenance gangs working on transmission and distribution lines. This winter, the Board are installing such sets in small buildings near the top of the 2,500 ft high Corrieyairack Pass which at present houses transmission line spares and provides overnight shelter for repair gangs working on the new 132 kV line over the Pass from Fort Augustus to Glen Truim. Two repair vans will be equipped with radio and the repair group will also carry walkie-talkie equipment. It is hoped that the use of radio in other areas will speed up the direction of vehicles and gangs to o.h. line breakdowns. Tests are being made in the Board's Northern, North Caledonia, Aberdeen, and South Caledonia areas. During experiments of transmitting messages from a hill near Dingwall, signals were received clearly at places as far away as Achnasheen, Inveran, Dornoch, Fasnakyle, Carrbridge and Boat of Garten.

Northern Ireland

It is expected that an announcement will shortly be made in the Ulster Senate on the Government's attitude towards hydro-electric development. A motion has already been tabled for discussion, which urges the Minister of Commerce to reject the proposed Bann hydro-electric scheme "as the expenditure, estimated at £2,195,000 could be applied more beneficially". The motion suggests that the Bann scheme is economically unsound having regard to statements that atomic energy will lead to an annual saving of 20 million tons of coal within 12 years. A report on the scheme has already been submitted to the Minister, but he has not yet announced his decision.

North Wales

The village of Llansantffraid on the banks of the River Vyrnwy, suffered almost a complete blackout recently when the Llansantffraid Electricity Co's rectifier plant was destroyed by fire. Many of the 950 population had to resort to oil lamps, until the Merseyside and North Wales Electricity Board came to the rescue with new rectifier plant.

Whitby

The North Eastern Electricity Board has replied to complaints by the Urban Council about poor voltage and flickering lights in several villages in the district. The Board said it was trying to extend electricity to as many villages as possible and it was not possible to calculate exactly what the load would be. The Board said every effort was being made to correct faults and asked consumers to be patient.

LIGHTING SCHEMES

Brierley Hills. The U.D.C. is recommended to install mercury vapour lamps in Bank St, John St, Moor St, Commonside and Pensett Rd, and that application be made for loan sanction for £6,210.

Crewe. T.C. proposes to spend £5,000 on improved street lighting.

Rhostyllen. Proposed new main road lighting is estimated to cost £2,089.

COMPANY ACTIVITIES

ANOTHER expanding unit in our industry is the Fenner group. Formerly J. H. Fenner and Co. the title now includes the word "Holdings." Last January, the trading undertakings were transferred to a wholly-owned subsidiary company. It also has associated companies: Henry F. Cockill and Sons, Mastabar Belt Fastener Co., Pioneer Oil Sealing and Moulding Co., Resilla Cots and Rollers Ltd., Manufacturers Equipment Co., and J. H. Fenner and Co. (India). Following the change it was decided to make accounts up to January last, a seven-month period. Although results cannot be compared with the previous year to 30 June, 1953, they show undeniable improvement. Group trading profits of £184,000 are equivalent to an annual rate of £315,000 against the previous figure of £272,000. From the figures available, earnings would appear to be about 98% compared with the actual dividend of 7½% declared (equivalent to the previous year's 12½%).

The chairman of Morphy-Richards endorses the view that the company should be able to maintain the 40% dividend rate on its increased capital. The new factory adjacent to the company's East Works will take a couple of years before it can contribute to earnings, a pointer to the future. In the meantime we have the sharp increase in sales this year and a strong demand for new Morphy products. Since my previous reference, shares have risen from 23s. to 24s. 6d. and they now yield 6½%. Once again I advise holders of the 6% Preference shares, who have been given notice of the board's intention, to redeem at 23s. on 31 Dec. next, to exercise their conversion rights. They can be converted into Ordinary at 15s. 9d. per Ordinary share, which means that every £1 Preference share now has conversion value of 31s., while their dividend income will go up from 6% to over 10%.

Pye Ltd. has acquired a small financial interest in Technograph (Printed Circuits), which specialises in the manufacture of printed electrical circuits for the radio, television, electrical, aircraft and other industries. Technograph is a private company with an issued capital of £55,000 in 50,000 £1 "A" shares and 100,000 1s. "B" (founders') shares. I understand the interest is less than 10% of the issued "A" shares.

It is evident from the results of Crompton Parkinson that declining orders and the smallness of business in some sections has been overcome. The consolidated net profit for the year to June last comes out at only a few thousands lower at £2,047,000 (*£2,059,000*). Dividend is maintained at 12½% and a special cash bonus of 7½% is repeated. There is also to be a share bonus of 25%. Associated company, the British Electric Transformer Co., made a net profit of £82,979 against £59,360. This company again pays 3s. per share on the 5s. Ordinary shares.—*From our City Correspondent.*

British Electric Transformer Co. Ltd.

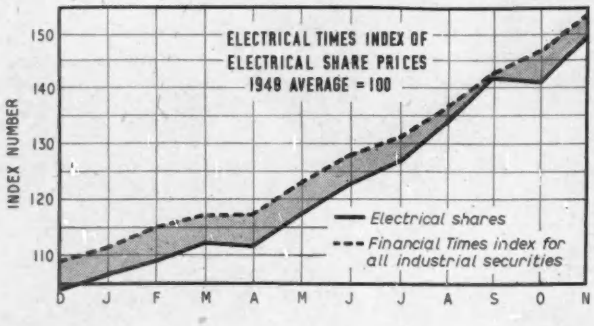
The net profit after all charges for the year ended 30 June last is £82,979, compared with £59,360 for the previous year. The dividend is again 3s. per 5s. Ordinary share.

Crompton Parkinson Ltd.

In announcing a final dividend of 7½% and a special cash bonus of 7½% for the year ended 30 June last (the same as last year) the directors give news of a proposed free scrip issue of Ordinary shares on a one-for-four basis. To effect this, it is proposed to raise the authorised capital from £4,200,000 to £5,950,000 by the creation of a further 7 million Ordinary shares of 5s. each, for which £48,370 will be taken from the capital reserves and £725,767 from unallocated revenue reserves. Group income for the year ended 30 June last amounted to £2,047,291 (*£2,058,871*), and the net income, after taxation, £838,175 (*£662,713*).

Elliott Bros. (London) Ltd.

In addition to declaring an interim dividend of 7%, the directors recommend a 50% free scrip issue to Ordinary shareholders by the capitalisation of £154,000 of the share premium account.



Share prices continue their steep rise. Electrical share prices recovered from their slight reversal during September and last month the "Electrical Times" index reached 149·3, a rise of 8·6. The "Financial Times" index for all industrial shares rose from 146·8 to 153·3

Holophane Ltd.

The volume of business was maintained at the previous year's level although the material supplies position was difficult. In spite of rising costs, the company endeavoured to stabilise the prices of its products, which resulted in a reduction of the trading profit. The directors state that in the proceedings instituted in America by the U.S. Government against Holophane Co., Inc., under the Sherman Anti-trust Act, judgment was given earlier this year which declared that the various agreements covering the commercial relations between the American and British company and the U.S. and the French company, are contrary to U.S.A. Law, and the American company was restrained from further performance thereof. A motion for a new trial and amendment of the judgment was sought, the result of which was awaited.

Year to 30 June	£ Trading Profit	£ Net Profit	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1950	90,655	41,457	75	15	13/–	9/6
1951	89,809	38,461	73	15*	10/6	7/6
1952	143,230	52,034	66	20	11/9	7/6
1953	126,193	46,915	57	20	13/9	11/1
1954	120,172	48,533	59	25	17/9	13/1

*Plus 50% capital bonus.

Longmore Brothers Ltd.

The profit for the year ended 4 Aug., has dropped to £39,550 compared with £92,736 for the previous year. The net profit figures are £14,750 and £37,036 respectively. The dividend has also been cut to 7½% as against 15% last time.

Midland Electric Manfg. Co. Ltd.

Treasury consent has been obtained to the capitalisation of £450,000 of reserves and to the issue to Ordinary shareholders of one £1 Ordinary share for each Ordinary share held. The directors also state that they intend, apart from unforseen circumstances, to recommend an Ordinary dividend of 10% for the year ending 31 Dec., next on the increased capital (equivalent to 20% on the existing capital). Last year the dividend was 15%.

Morphy-Richards

There was every reason to believe that the 40% dividend paid since the company was made public in 1947 should be at least maintained on the capital is to be increased by conversion of Preference shares, Mr W. Wansbrough, the chairman, has stated. Sales of the group rose by 38% for the year ended 30 June last, and for the first three months of the current year were 49% above the corresponding period of 1953-54. This increase was equally spread over the home and export markets, he adds.

Dividends Declared

W. Canning and Co. Interim of 5% (*10%*) on doubled capital.

Garrard Engineering and Manufacturing. Interim 10% (*same*).

Pressed Steel Co. Interim of 7½% (*5%*).

Rawlplug Co. Interim of 10% (*15%*) on capital doubled by scrip issue.

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

5 Nov.—Belfast T.C. Electric hoist-block and 12 in. bore parallel slide valve for steam plant.—Advertised in 14 Oct. issue.

5 Nov.—Bradford. Lamps during 1955 for hospitals in Bradford A Hospital Management Group.—See 21 Oct. issue.

5 Nov.—N. Ireland. Installation in Gardenmore Presbyterian Church, Larne.—See 7 Oct. issue.

5 Nov.—Westhoughton U.D.C. Street lighting in Newbrook Rd. (A.579).—See 21 Oct. issue.

5 Nov.—Wrexham T.C. Columns, lanterns, lamps and time-switches for Group A and B street lighting. Advertised in 14 Oct. issue.

6 Nov.—Ashton-in-Makerfield U.D.C. Street lighting in Birch Grove and Leyland Green Rd, and on Landgate Lane estate.—See 28 Oct. issue.

6 Nov.—Dublin T.C. Circuit-breakers and condensers for public lighting dept. —See 28 Oct. issue.

6 Nov.—Durham. Installation at five schools.—See 28 Oct. issue.

6 Nov.—Manchester T.C. Electrical equipment for Municipal College of Technology.—See 28 Oct. issue.

6 Nov.—Windsor T.C. Lamps, fittings and cable during 1955.—See 14 Oct. issue.

8 Nov.—Aldridge (Staffs.) U.D.C.—Group A street lighting units along Birmingham Rd. (A.34).—See 21 Oct. issue.

8 Nov.—Banstead (Sur.) T.C. Concrete columns and lanterns for joint housing scheme of three boroughs.—See 21 Oct. issue.

8 Nov.—Leyland U.D.C. Supply of 130 lanterns and fittings for 80 W mercury-vapour fluorescent lighting (class B). F. D. Howe, Engineer and Surveyor, Council Offices.

9 Nov.—Chadderton U.D.C. Erection of 58 group A concrete street lighting columns. Engineer and Surveyor, Town Hall.

9 Nov.—Northamptonshire. Electrical and heating installation at Corby and Daventry new modern schools, and Wellingborough secondary technical school. Notify County Architect, County Hall, Northampton.

10 Nov.—Inverness T.C. Electrical work in 26 houses in Diriebught Rd. Burgh Architect, J. Blackburn, 11 High St.

11 Nov.—Dagenham T.C. Power factor correction equipment at Riverside Sewage Works.—See 28 Oct. issue.

13 Nov.—E. Lothian. Electrical work in reconstruction of Clark Buildings, Ormiston.—See 28 Oct. issue.

13 Nov.—Peterborough T.C. Lighting and power installations in 48 houses on Eastfield estate. Applications by above date to L. H. Robjohn, acting City Engineer and Surveyor, Town Hall. Deposit £2. 2s.—Advertised in this issue.

15 Nov.—Dublin T.C. Installation in Technical School for Boys in Collins Ave.—See 28 Oct. issue.

15 Nov.—Edinburgh. Maintenance work at five institutions during 1955.—See 28 Oct. issue.

16 Nov.—Hazel Grove and Bramhall U.D.C. Concrete and steel columns, lanterns, etc., along Buxton and Macclesfield Rds.—Advertised in 14 Oct. issue.

17 Nov.—Co. Armagh. Electrical installation in 32 houses at Markethill. N. Ireland Housing Trust, 12 Hope St, Belfast. Deposit 10s.

17 Nov.—Kincardine. Street lighting for Silverbank estate.—See 21 Oct. issue.

18 Nov.—Belfast T.C. Extensions to pneumatic dust removal and surface installation at Power Station West.—Advertised in 14 Oct. issue.

18 Nov.—Dublin. Electrical installation at out-patients' dept. of National Children's Hospital, Harcourt St. Consulting engineers, J. A. Kenny and Partners, 44 Kildaire St. Deposit £10. 10s.

18 Nov.—Lichfield T.C. Steel columns, brackets, sodium and fluorescent lanterns for Group A lighting along A.51.—Advertised in 28 Oct. issue.

20 Nov.—Eire. Gt. Northern Railway Board requires supply of power, heating, and lighting accessories, storage batteries, conduit, wire and cables, lamps, electrodes, etc during 1955. Documents at General Stores Depot, Dundalk.

22 Nov.—Southampton T.C. Installation at Technical College.—Advertised in 28 Oct. issue.

23 Nov.—Co. Tyrone. Supply of stand-by generating set at Loughry Agricultural College, Cookstown. Ministry of Finance (Room 103), Law Courts Bldgs, May St, Belfast.

24 Nov.—Co. Down. Electrical services at Donaghadee intermediate school. —See 28 Oct. issue.

24 Nov.—Littlehampton U.D.C. Installation in 12 houses on Wickbourne estate.—See 21 Oct. issue.

29 Nov.—Bletchley U.D.C. Supply of 59 concrete columns and 3-light fluorescent lighting units. J. F. Smithie, Engineer and Surveyor, Council offices.

30 Nov.—Tottenham B.C. Lamps wanted in year from 1 Apr.—See 14 Oct. issue.

No date stated.—N. of Scotland H.E. Board. Construction of 11 kV and lower voltage wood-pole o.h. lines in N. Perthshire. Kennedy and Donkin, 3 North Charlotte St, Edinburgh. Deposit £2. 2s. —Advertised in this issue.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon House, Theobalds Rd, W.C.1, quoting reference.*

23 Nov.—India. Supply of four 75 kW four 250 kW and four 150 kW diesel generating sets with accessories and control panels for four proposed pilot power stations in North Bihar. Superintending Engineer, Central Technical Circle, Electricity Dept., Patna. Fee Rs. 5.

23 Nov.—U.S.A. Supply of main unit lighting substations for Dallas Dam power house. District Engr., U.S. Army Corps of Engineers, 628 Pittock Block, Portland 5, Oregon. B.o.T. (Ref.: ESB 24585/54).*

25 Nov.—S. Rhodesia. Supply of one loading resistor for load-testing the generators of English Electric 2,000 h.p. diesel-electric locomotives. Rhodesia Railways, P.O. Box 603, Bulawayo. B.o.T. (Ref.: ESB 24480/54).*

30 Nov.—U.S.A. Supply of turbine governing equipment with auxiliaries for 123,800 h.p. and 18,800 h.p. turbine units. District Engr., Corps of Engineers. U.S. Army, 628 Pittock Block, Portland 5, Oregon. Tender No. Civeng 35-026-55-64. B.o.T. (Ref.: ESB 24247/54).*

1 Dec.—Australia. Supply of 50 kVA and 150 kVA 3-phase 50 c/s 22,000/230V auxiliary transformers, for Victorian Railways Commissioners, Melbourne. Contract no. 60274. B.o.T. (Ref.: ESB 24966/54).*

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources including an index of trade information with over 100,000 entries

A Selection from the 119 queries answered this week

Circular fluorescent tubes in more than one size, rating and colour, makers of? J.W.—Bright Light Installations Ltd., 6 Avenue Rd, N.W.10.

Standard Insulator Co., Ltd., address of? D.F.—Standard Works, Bridge Rd, Camberley. (Telephone No. Camberley 1813.)

"Whites" inspection lamps, suppliers of? W.H.P.—J. C. White and Co., Ltd., 11 Albert Place, Manchester.

"Halo" illuminated mirrors, makers of? P.S.—Woodfyt Mfg. Co., Ltd., 14 Selons St, N.W.1.

"Pneulec Le Royer" compost shredder, makers of? B.I.C.—Pneulec Ltd., Mafeking Rd, Smethwick, Staffs.

"Hanlo" water pipe fittings, makers of? D.C.A.—Lovell and Hanson Ltd., Spon Lane, West Bromwich.

Whistling, etc., electric kettles, makers of? J.H.C.—Best Products Ltd., Felix Works, Felixstowe; Bulpitt and Sons, Ltd., Icknield St, Birmingham 18; W. T. French and Son, Ltd., Browning St, Birmingham 16.

"Kumanal" resistance wire, makers of? S.B.C.—I.C.I. Metals Ltd., Witton, Birmingham.

1 Dec.—India. Supply and erection of a 60,000 lb./hr steam boiler with stoker, superheater, economiser, accessories, etc., for Neliore Thermal station. K. P. Bhat, executive engineer, 20 Rutland Gate, Nungambakkam, Madras 6.

1 Dec.—Iraq. Central Foreign Purchasing Board require table model manual switchboards and telephone protectors. B.o.T. (Ref.: ESB 24613/54).*

6 Dec.—Tangier. Water and Electricity Board require modifications of h.t. outlets ("Sorties") at Moghogha power station. Regie des Services de l'Eau et de l'Electricite, Rue Vermeer, 4, Tangier. B.o.T. (Ref.: ESB 25075/54).*

8 Dec.—Australia. Supply of one (or two) 18,000 kW water-driven turbo-alternator, 11,000 V 3-phase, 50 c/s head approx. 1,485 ft., for Cairns Electricity Board. Specifications T8/19 at £3. 3s. per copy from State Electricity Commission of Queensland, Eagle St, Brisbane.

15 Dec.—Australia. Victorian Railways Commissioners invite tenders for supply of eight 1,500 kW automatically-controlled rectifier units. Contract No. 60268. B.o.T. (Ref.: ESB 24947/54).*

16 Dec.—Australia. State Electricity Commission of Western Australia invites tenders under schedule 498 A for two 3,010 kVA 22,000/3,000 V transformers and two 1,000 kVA 3,000/440 V auxiliary transformers, oil immersed, outside installation, 3-phase 50 c/s for East Perth and South Fremantle power stations: and under schedule 499 A for 10 air circuit-breakers, rupturing capacity 23,000 A, two 1600 A, and two 400 A, off-load isolators and 14 H.R.C. switch-fuse units, 400 V, 3-phase, 40 c/s for East Perth power station. Documents from Govt. Liaison Officers, 305 Collins St, Melbourne, and 82 Pitt St.

2 Jan.—India. Supply of 3.000 V overhead equipment excluding structures for electrification of Howrah-Burdwan line including Tarakeshwar branch line. Engineer-in-Chief, Calcutta Electrification Project, Eastern Railway Bldg, 17 Netaji Subhas Rd, Calcutta. Deposit Rs. 30.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, 2 November

	£ per ton	Weekly change £	Price last year £
COPPER, standard class A (settlement)	280	+2½	240
„ (3 months)	260⅝	−1½	223⅜
LEAD, refined pig, min. 99·97% purity (cash)	108	−3	95⅜
„ (3 months)	102⅜	−¼	90⅜
TIN, refined, min. 99·75% purity (settlement)	731	−1	616½
„ (3 months)	728	—	606½
ALUMINIUM, ingots 99-99·5%	150	—	150
ZINC, virgin, min. 98% purity (cash)	81⅜	+⅜	75⅞
„ (3 months)	81⅛	+⅜	74⅛
RUBBER No. 1, RSS. spot (per lb.)	23¼d.	−1⅛d.	16d.-16¼d.
„ c.i.f. basis, ports, Dec. (per lb.)	23¼d.	+⅛d.	16d.-16¼d.
ARMOURING:			
Galv. Steel Wire (0·104 in.)	52½	—	50½
Mild Steel Tape (0·014 in.)	40½	—	40

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, W.C.2.

L. Wilkinson (Croydon) Ltd. 19 Lansdowne Rd, Croydon, Surrey. Manufacturers of and dealers in electrical and radio and television and electronic and mechanical apparatus and accessories, etc. Nom. cap.: £5,000. Dirs.: L. Wilkinson and Ena M. Wilkinson.

E. Gordon Hill and Son Ltd. 15/17 Chatham Place, Edge Hill, Liverpool 2. To take over business of heating and ventilating engineers carried on at Liverpool by Eric G. Hill and R. J. Hill. Nom. cap.: £10,000. Dirs.: E. G. Hill, Mrs. L. Hill, R. J. Hill and Mrs. M. Hill.

Grosvenor Facilities Ltd. 12 Catford Broadway, S.E.6. Buying, selling and letting on hire and entering into hire purchase agreements in respect of radios, televisions, washing machines, electrical equipment, etc. Nom. cap.: £2,000. Dirs.: J. Stukings and Mrs V. Stukings, Mrs G. Edwards and E. Skinner.

John Phillip and Son Ltd. 38 Otley St, Skipton, Yorks. Electrical engineers and general electric installation contractors, lighting specialists, etc. Nom. cap.: £3,000. Dirs.: J. Phillip, senr, and J. Phillip, junr.

F. and R. Rentals Ltd. 831 Manchester Rd, Castleton, Rochdale. Electrical, radio and television engineers and dealers, etc. Nom. cap.: £2,000. Dirs.: J. W. Forth and Mrs N. Forth, J. Baron and Mrs G. Baron.

Transvision Ltd. 10 Queen St, Cheapside, E.C.4. Manufacturers of and dealers in electronic and mechanical apparatus and accessories, etc. Nom. cap.: £100. Dirs.: F. Gould and B. G. Martindill.

Sylvania - Thorn Colour Television Laboratories Ltd. 105 Judd St, W.C.1. Nom. cap.: £10,000. Dirs.: J. Thorn and H. Ward Zimmer.

Brown Raven Ltd. Cooper Hse Mills, Luddenden Foot, near Halifax. General, precision, mechanical, motor, aeronautical, electrical and constructional engineers, etc. Nom. cap.: £1,000. Dirs.: to be appointed by subs. Subs.: D. Naylor, 126 East View, Lee Mount, Halifax; and E. Porter, 5 Alma Rd, Horley Green, Halifax.

Seamgel Ltd. 45 Becketts Park Drive, Leeds, 6. Manufacturers and inventors of and agents for domestic appliances and machines, manufacturers of and dealers in machines for washing, cleaning, rinsing, wringing, ironing, dyeing and proofing of clothing and textiles etc. Nom. cap.: £500. Dirs.: T. W. Davenport, Mrs L. Davenport and Miss D. P. Davenport.

G. Philip and Co., Ltd. 7 Ashton Lane, Sale, Cheshire. To carry on business of radio, television and general electricians, mechanical engineers and manufacturers, etc. Nom. cap.: £500. Dirs.: G. P. Worthington and Mrs B. J. Worthington.

Gordon Electrics Ltd. Gordon Rd, Lea Rd, Waltham Abbey, Essex. To take over business of Gordon Electrics (Motor Vehicle Mechanics) carried on at Waltham Abbey, Essex, by George F. Bruntlett: garage proprietors, etc. Nom. cap.: £100. Dirs.: G. F. Bruntlett, Doris L. Bruntlett and K. J. Monk.

Palladin Lamps Ltd. Aldermans Hse, Bishopsgate, E.C.2. Manufacturers of and leaders in electrical appliances and accessories, etc. Nom. cap.: £100. Dirs.: Mrs. M. F. A. Spong and Hon. W. F. B. le Poer Trench.

Phillips of Gillingham Ltd. 82 Watling St, Gillingham, Kent. Electrical engineers and contractors, etc. Nom. cap: £2,000. Dirs.: Archie S Phillips, L. S. Phillips and Arnold S. Phillips.

Contracts Placed

Biddulph (Staffs) U.D.C. Installation in 168 houses on Park Lane estate, Speed Electric Service, £2,922.

Chichester T.C. Improved street lighting in Oving Rd, Southern Electricity Board, £1,798.

Durham. Installations in following schools: Felling Falla Park, Park Rd, county, Dougal and Railton, £1,645; Wilton Gilbert county infants, R. Robson, £447; and Jarrow St Peter's C.E. controlled, A. F. Jamieson, £210.

Durham R.D.C. Installation at Sherburn sewerage works, F. Reid Ferens and Co., Ltd., £1,024.

London. Installation at Peckham Pk primary school, Thorpe and Thorpe Ltd., £4,522.

Luton T.C. Installation at William Austin primary school, H. A. Cawdell, £3,249. Also supply of 90 concrete columns and 100 sodium lanterns for street lighting, Stanton Ironworks Ltd (£1,971), and Engineering and Lighting Co., Ltd., £1,129 resp.

Norwich. Electrical engineering services for the burns treatment unit at West Norwich Hospital, Johnson Pearce and Co. £1,231.

Norwich T.C. Electrical equipment, cables and wiring for Sewage Disposal Works, Eastern Electricity Board, £7,084.

Peterlee (Durham). Electrical installation in 310 new houses at Acre Rigg, for Development Corporation, J. Calvert (Electrical) Ltd.

Plymouth T.C. Installation of electricity in 237 houses, G. R. Ennor, £2,090.

Preston T.C. Installation at Harris Library, Art Gallery and Museum, Alfred Williams and Son (Preston) Ltd., £2,067.

Rowley Regis T.C. Laying underground cable connections for street lighting in Dudley Rd. Clough Smith and Co., Ltd. £1,185.

Stourbridge T.C. Class "A" lighting in eight roads, Revo Electric Co. £10,602.

West Hartlepool T.C. Installation in shops in Balmoral Rd, Edgar Phillips Ltd., also conversion of street lighting from gas to electricity, B. L. Oliver.

West Hartlepool. Installation in new operating theatre at General Hospital, Edgar Phillips Ltd., £960.

BUSINESS PROSPECTS

Home

Aberdeen. Plans approved for 3-storey building and remodelling of Rosehearty school, at estimated cost of £67,654.

Ayr T.C. Dean of Guild Court has approved erection of offices in Prestwick Rd for N. G. Napier Ltd. Erection of £22,000.

Banffshire. Schools to be built at Keith, Macduff, Whitehills, Cullen, Glenrimes, Netherdale and Dunlugas.

Barking. S. Nagil, 784 High Rd, N.14, propose to erect factory in Ripple Rd.

Barnsley T.C. Plans in hand for reconstruction of Gaumont Cinema in Eldon St for Circuit Management Assoc. Ltd., 5 Bainbridge St, London, W.C.1.

Bath. Territorial Army centre costing some £60,000 to be built at Green Park. Architects are Petter, Warren and Roydon Cooper, The Old Oxford Inn, Hendford, Yeovil.

Bath. Extensions and improvements approved to Royal National Hospital for Rheumatic Diseases. Cost estimated at £100,000.

Birmingham. Police station, flats and garage to be built in Bradford St. Estimated cost, £96,627.

Blairgowrie (Perth). Smedley's Ltd. to erect a factory for which architects are Lowe and Barrie, 65 Nethergate, Dundee.

Blyth T.C. Erection of 25 houses in Coomassie Rd being planned.

Bromley T.C. Erection of Pickhurst county primary junior school. Borough Engineer, Municipal Offices.

Cardiff T.C. Construction of 110 dwellings at Llanrumney. City Surveyor's Office, City Hall.

Cleethorpes T.C. Construction of 44 dwellings on Trinity Rd site. A. B. Cooper, Borough Engineer, Council Hse.

Co. Down. Modified plan prepared for conference hall by architect, S. A. Devon, 9 Wellington Pl, Belfast. Cost estimated at about £65,000.

Coventry. Scheme in hand for casualty and fracture unit, and reconstruction of first and second floor wards at Coventry and Warwickshire Hospital. Cost estimated at £308,972. Plans being prepared for secondary modern schools and grammar school by Catholic Authorities. Estimated cost £400,000.

Crawley (Sus.). Extensions proposed by Vitamins Ltd. at new town costing about £40,000. Quantity surveyors are H. J. Venning and Partners, 16 Gower St, London, W.C.1.

Derby. Site has been purchased by Bemrose and Sons Ltd., printers, at Nottingham Rd, Spondon, for proposed new premises.

Dublin. Trinity College Trustees planning library between Fellow's Garden and College Park to cost about £450,000.

Edinburgh. Dean of Guild Court has approved reconstruction of cinema in Princes St as departmental store for Marks and Spencer Ltd. Cost will be about £300,000.

Also University Authorities to build College of Agriculture at King's Bldgs, West Mains. Reid and Gibson of Melville St are quantity surveyors, and cost is estimated at £370,000.

Exeter. Junior modern school to cost about £82,000 will be built at Whipton Barton.

Gateshead. Perga Cartons Ltd. propose additions to factory covering 14,000 sq. ft. on Team Valley trading estate. Electrical consultants are R. W. Gregory and Partners, Pilgrim Hse, Newcastle. Also Reavell and Cahill, Lloyds Bank Chambers, Alnwick, are architects for proposed R.C. church in Watson St, Gateshead.

Glasgow. Six-storey building to be erected in Ingram St by Arthur and Co., Ltd., at estimated cost of £300,000. Frank Burnett and Boston, 180 Hope St, are architects.

Harlow. Proposed to erect new courthouse, two petty sessional courts and other accommodation at New Town. Estimated cost, £61,900.

Hinckley U.D.C. Further development of Sketchley Hill estate proposed.

Huntingdonshire. Secondary modern school to be built at Sawtry.

Kensington B.C. Scheme to be considered for erection of new town hall and central library on Abbey site in Hornton St. Estimated cost, £750,000.

Kirkcaldy. Amended sketch plans approved for extension to Victoria Hospital. Cost estimated at £100,000.

Leeds. Approval sought for five-storey extension to General Infirmary costing £175,000. Also, new office block costing £83,400 being considered for City Architect's Dept.

Macclesfield. Scheme approved for alterations, etc., at county grammar school for girls. Total cost estimated at £100,000.

Maidenhead T.C. Approval sought for erection of new municipal buildings on St. Ives Rd site.

Middlesbrough T.C. It is proposed to erect three children's homes next year at cost of £10,000.

Newcastle-under-Lyme. Scheme approved for £167,000 civic centre in Merrial St. Architects are Bradshaw, Gass and Hope, 19 Silverwell St, Bolton.

Newcastle-on-Tyne. Approval in principle given to a £50,000 scheme for alterations to Walkergate Hospital. Quantity surveyors are Barrett and Sons, 17 Brunswick Place.

Norwich. Salthouse Rd industrial estate is being developed rapidly. J. Taubman is to erect 14 more factories there next year. Total of 23 factories envisaged. Architect is W. A. J. Spear, 36 Cattlemarket St.

Oldham T.C. Erection of 46 bungalows on Holts estate. Cameron and Middleton, chartered quantity surveyors, 21 Queen St.

Reading. Plans approved for research laboratory in College Rd for G. Luzky; and for erection of offices in Frier St for Prudential Assurance Co., Ltd.

Rochdale. Courtaulds Ltd. to build new research building opposite Arrow Mill, Queensway.

Rugby. New laboratories and office alterations in Lawford Rd planned by Rugby Portland Cement Co., Ltd.

Sheffield T.C. Erection of 75 maisonnettes and flats at Busk Meadow. J. L. Womersley, City Architect, Town Hall.

Skipton U.D.C. Construction of 24 bungalows on Horse Close estate. Engineer and Surveyor, Town Hall.

Swansea T.C. Erection of Mynyddbach county secondary school for girls. Borough Architect, The Guildhall.

Walsall T.C. Hoare Lea and Partners have been appointed electrical consultants for erection of flats at Little Bloxwith South, Dudley's Fields and Burrowes St.

West Riding. New school for juniors and infants at Bawtry will cost about £37,400.

Whitby U.D.C. Hundred houses to be built on north-west section of White Leys estate.

Overseas

Philippines. Representation of U.K. suppliers of turbine pumps, irrigation centrifugal pumps, diesel generating sets from 100 kW, wires and cables, sought by Radiowealth Inc., 500 Tandnay St, Manila.

South Africa. Mr E. M. Bandhuin, managing director, A.C.E.C. South Africa (Pty) Ltd., A.C.E.C. Hse, corner Henri and Smit Sts, Johannesburg (P.O. Box 1894), has expressed wish to represent U.K. suppliers of electrical equipment. Goods include control gear, circuit-breakers, switchgear for motors, alternators, power house equipment, industrial distribution boards, measuring and metering instruments.

Gazette Announcements

COMPANY ACTS

Mayfield Electrics Ltd. Meeting of members and creditors will be held at 11-12 Finsbury Sq., London, E.C.2, on 16 Dec. at 3 p.m. to receive liquidator's report.

Electric Cables Ltd. Meeting of members will take place at 3 Great Winchester St, London, E.C.2, on 26 Nov. at 12.30 p.m. to receive report of liquidator.

BANKRUPTCY ACTS

Release of Trustee

Carlisle. George S. Graham, electrical engineer, trading at Blackfriars St, Carlisle. Trustee was D. Atkinson, Official Receiver, 14 Lowther St, Carlisle.

London. Alfred J. Rigby, electrical contractor, lately of 8 Doughty Mews, W.C.1. Trustee was W. F. Cresswell, Sr. Official Receiver, Bankruptcy Bldgs, Carey St, W.C.2.

Intended Dividends

Ipswich. Jack Cooper, mechanical and electrical engineer, trading at Market Place, Orford. Last day for receiving proofs, 12 Nov. Trustee is C. A. Taylor, Official Receiver, 3-5 Northgate St, Ipswich.

Birmingham. Henry Tansey, electrical contractor, of 53 Hollydale Rd, Birmingham. Last day for receiving proofs, 13 Nov. Trustee is R.K. Clark, Official Receiver, Somerset Hse, Temple St, Birmingham.

Dividends

Birmingham. Frank H. Pountney, trading as Bordesley Electrical Co. at 164 High St, Bordesley. Supplemental dividends of 2s. 3½d. in £ payable at Office of Official Receiver, Somerset Hse, Temple St, Birmingham, on 18 Nov.

Great Grimsby. Brian T. Smith, electrical engineer and contractor, trading at The Studio, Ramsgate, Louth. First and final dividends of 3½d. in £ payable on 16 Nov. at 26 South St. Mary's Gate, Grimsby.

MEETINGS TO NOTE

THURSDAY, 4 NOV.

I.E.E. (London). "A Transatlantic Telephone Cable," Sir Gordon Radley, G. W. Gilman and R. J. Halsey. Savoy Place, W.C.2, 5.30 p.m.

I.E.E. (Rugby). Chairman's address by D. Edmundson. Meeting at Banbury.

I.E.S. (Glasgow). "Design and Application of Flameproof Lighting Equipment," D. A. Strachan. 39 Elmbank Cres., 7.30 p.m.

I.E.S. (Nottingham) "Lighting of Shipyards," J. S. McCullock. Elect. Offices, Smithy Row, 6 p.m.

BRITISH INSTN. OF RADIO ENGRS. (Scottish). "Latest Developments in TV Cameras," H. McGhee. 39 Elmbank Cres, Glasgow, 7 p.m.

BRITISH INSTN. OF RADIO ENGRS. (Merseyside). "Radio Receiving Valve Manufacture," G. P. Thwaites. College of Tech., Byron St, Liverpool, 7 p.m.

BRITISH INSTN. OF RADIO ENGRS. (N. Western). "Electronic Servo Mechanisms," J. L. Russell. College of Tech., Sackville St, Manchester, 7 p.m.

A.S.E.E. (S. London). Lecturettes at Cafe Royal, Croydon, 8 p.m.

CHELMSFORD ENGRNG. SOC. "Owen Falls, Uganda Hydro-Electric Development," Sir Charles Westlake. Hoffmann's Social Hall, 7.30 p.m.

FRIDAY, 5 NOV.

I.E.E. (N. Eastern) "Safety in Use of Portable and Transportable Equipment in Industry," J. W. Bunting. Cumberland Tech. College, Workington, 7 p.m.

INSTN. OF MECH. ENGRS. "Experimental Coal-burning Gas Turbine," Prof D. L. Mordell. Birdcage Walk, Westminster, 5.30 p.m.

INSTN. OF FUEL (S. Wales). "Back-pressure Regeneration," C. Ungold. Y.M.C.A., Kingsway, Swansea, 6 p.m.

IPSWICH ELECTRICAL ASSOC. "Electrical Installations in Ships," E. L. Towle. Electric Hse, 7.30 p.m.

BIRMINGHAM ELECTRIC CLUB. Golden Jubilee Banquet at Grand Hotel, Colmore Row, 6.30 p.m.

A.S.E.E. (N.W. London). "Control of Industrial Refrigerating Plant," F. J. Hagger. Century Hotel, Forty Ave, Wembley Park, 8.15 p.m.

A.S.E.E. (Liverpool). "Modern Lighting Technique," R. Pye. Liverpool Engineering Society, 24 Dale St, 7.30 p.m.

MONDAY, 8 NOV.

I.E.E. (London Education). Discussion on "Methods of Teaching Technical Writing," G. Parr. Savoy Place, W.C.2, 6 p.m.

I.E.E. (Cambridge Radio Group). Radio Section Chairman's address by C. W. Oatley. Cavendish Laboratory, Free School Lane, 8.15 p.m.

I.E.E. (Mersey and N. Wales). Annual dinner at Exchange Hotel, Liverpool, 7 p.m.

I.E.E. (N. Eastern). "Safety in Use of Portable and Transportable Electrical Equipment in Industry," J. W. Bunting. Neville Hall, Westgate Rd, Newcastle, 6.15 p.m.

I.E.E. (S. Midland Supply and Utilisation). "Use of Electricity in Production of Calcium Carbide," C. J. Beavis. Imperial Hotel, Birmingham, 6 p.m.

I.E.E. (Western Supply). "Some Design Features of Semi-Outdoor Power Station at Ince," F. H. S. Brown. Elect. Offices, Colston Ave, Bristol, 6 p.m.

I.E.S. (Sheffield). "Lighting for Display," T. S. Jones. The University, Western Bank, 6.30 p.m.

INST. OF FUEL (N. Eastern). "Smoke Abatement," Dr A. C. Monkhouse. King's College, Newcastle, 6.30 p.m.

LEICESTER ELECTRICAL SOC. "TV Production from Engineers' Viewpoint," D. R. Campbell. Elect Offices, Charles St, 7 p.m.

INCORP. PLANT ENGRS. (Dundee). Refrigeration Problems," G. S. R. Shaw. Mathers Hotel, 7.30 p.m.

I.E.E. (N. Midland). "Owen Falls, Uganda Hydro-Electric Development," Sir Charles Westlake, R. W. Mountain, and T. A. L. Paton. Leeds University, 7 p.m.

A.S.E.E. (Central London). "M.I.C.C. Cables," G. E. R. Ledman. St. Ermin's Hotel, Caxton St, S.W.1, 6.15 p.m.

E.P.E.A. (London). "Applications of Electronic Control." R. H. Kelsall, Caxton Hall, S.W.1, 7 p.m.

TUESDAY, 9 NOV.

I.E.E. (London Measurements). Section dinner at Cafe Royal.

I.E.E. (E. Midland). "Properties and Application of High Permeability Magnetic Alloys," G. A. V. Sowter. Loughborough College, 6.30 p.m.

I.E.E. (N. Eastern). "Owen Falls, Uganda Hydro-Electric Development—General Aspects," Sir Charles Westlake and R. W. Mountain. King's College, Newcastle, 6.15 p.m.

I.E.E. (N. Midland). Discussion on "New I.E.E. Examination Regulations," E. C. Walton. Elect. Offices, 1 Whitehall Rd, Leeds, 6.30 p.m.

I.E.S. (London). "Shop Lighting," R. L. C. Tate. Lighting Service Bureau, Savoy Hill, W.C.2, 6 p.m.

I.E.S. (Cardiff). "Lighting Installation in Nylon Yarn Factory," B. C. Robinson.

NEWPORT ELECTRIC CLUB. (As I.E.S. (Cardiff) above.)

INCORP. PLANT ENGRS. (Manchester). "Engineering Economics," T. S. Welch. Engrs. Club, Albert Sq, 7.15 p.m.

ELECTRICAL INDUSTRIES CLUB. Monthly luncheon at Connaught Rooms, London.

WEDNESDAY, 10 NOV.

I.E.E. (London Radio and Measurements). "Standard Frequency Transmissions," L. Essen; "Standard Frequency Monitor at National Physical Laboratory," J. McA. Steele; "Standard Frequency Transmission Equipment at Rugby Radio Station," H. B. Law. Savoy Place, W.C.2, 5.30 p.m.

I.E.E. (N. Scotland). "Electricity in Wool Textile Industry," A. J. Francis and T. H. Carr. Caledonian Hotel, Aberdeen, 7.30 p.m.

I.E.E. (S.E. Scotland). "Owen Falls, Uganda Hydro-Electric Development," Sir Charles Westlake, T. A. L. Paton and R. W. Mountain. North British Hotel, Edinburgh, 6 p.m.

I.E.E. (Southern). Discussion on "Use of Electricity in Farming." Elect Showrooms, 17 New Canal, Salisbury, 6.30 p.m.

I.E.E. (Oxford). "British Atomic Factories," K. E. B. Jay. Elect. Offices, 37 George St, 7 p.m.

I.E.S. (Swansea). "Electric Lighting in Nylon Yarn Factory," B. C. Robinson. Elect. Offices, The Kingsway, 6.30 p.m.

INST. OF FUEL (N. Western). "Gas Turbines," F. Hickson. Engrs. Club, Albert Sq, Manchester, 6 p.m.

INCORP. PLANT ENGRS. (E. Midlands). "New Development in Laundry Washing Machines," B. A. Clark. Adult Educ. Centre, Shakespeare St, Nottingham, 7 p.m.

BRITISH INSTN. OF RADIO ENGRS. (N. Eastern). "Stereophonic Sound," R. A. Bull. Neville Hall, Westgate Rd, Newcastle, 6 p.m.

A.S.E.E. (Birmingham). Lecturettes at Chamber of Commerce, New St, 7 p.m.

A.S.E.E. (Bradford). "Power Factor Correction," J. W. L. Fall. Midland Hotel, 7.30 p.m.

A.S.E.E. (York). "Factory Ventilation." Picture House Cafe, Coney St, 7.15 p.m.

THURSDAY, 11 NOV.

I.E.E. (London). "Overhaul and Maintenance of D.C. Traction Motors." J. G. Bruce. Savoy Place, W.C.2, 5.30 p.m.

I.E.E. (N. Scotland). "Electricity in Wool Textile Industry." Univ. College, Dundee, 7 p.m.

I.E.E. (Swansea). "Safety in Use of Pottable and Transportable Electrical Equipment in Industry," J. W. Bunting. Elect. Showrooms, The Kingsway, 6 p.m.

I.E.S. (Birmingham). Ladies' Night at Botanical Gardens Ballroom, Westbourne Rd, Edgbaston.

I.E.S. (Manchester). "Street Lighting Costs," T. L. Robinson. Elect. Offices, Town Hall, 6 p.m.

DERBY ELECTRICAL SOC. "Industrial Photography," E. J. Grimswade. Elect. Showrooms, Irongate, 7 p.m.

E.I.B.A. (W. Lancs, Mersey and N. Wales). Annual buffet dance at Hotel Victoria, New Brighton.

INCORP. PLANT ENGRS. (Newcastle). "Industrial Lubrication," N. Errington. Roadway Hse, Oxford St, 7 p.m.

BRITISH INSTN. OF RADIO ENGRS. (Scottish). "Nuclear Fission and Nuclear Fusion," Prof N. Feather. The University, Edinburgh, 7 p.m.

ROYAL STATISTICAL SOC. (Industrial Applic Group—Glasgow). "Use of Random Observations to increase Productivity," J. H. Hepburn. 39 Elmbank Cres, 7.30 p.m.

FRIDAY, 12 NOV.

I.E.E. (Tees-side) Annual dinner at Zetland Hotel, Saltburn, 6.30 p.m.

I.E.E. (N. Ireland). "Owen Falls, Uganda Hydro-Electric Development—General Aspects," Sir Charles Westlake, J. A. L. Paton and R. W. Mountain. Queen's Univ., Belfast, 6.30 p.m.

I.E.E. (Swansea). Annual dinner and dance at Langland Bay Hotel, Mumbles.

E.P.E.A. (Meter Engrs. Group). "Principle of the Current Transformer." A. Hobson. Caxton Hall, Westminster, 6.30 p.m.

ELECT. TRADES COMMERCIAL TRAVELLERS' ASSOC. (Midlands). Annual dinner at Queens Hotel, Birmingham.

TRADE NOTES

Change of Address. The Southern Sales Offices of Connellys (Blackley) Ltd., are now at 23 Starcross St, London, N.W.1. These premises have been purchased with a view shortly to open a London store for direct local delivery, and collection of empties.

Divisional Sales Offices. Expanding their sales policy and organisation for "Servis" washing machines, Wilkins and Mitchell Ltd, have opened two new divisional sales offices covering the North West and North East respectively. They are: Divisional sales manager, Mr M. Chadwick, at Chicago Bldgs, Liverpool. (Telephone No. Central 9392.); and divisional sales manager, Mr W. B. Bell, at 51 Grainger St, Newcastle-on-Tyne, 1. (Telephone No. 29331).

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Wayin. 728,264. Class 7. Self-winding reels for cables, etc. Power House Components Ltd., Albion Chambers, King St, Nottingham.

Aeroflow. B 730,488. Class 7. Conveyors for granular and powder materials. Henry Simon Ltd., Bird Hall Lane, Cheadle Heath, Stockport, Cheshire.

Sew-Lok. B 731,108. Class 7. Sewing machines. Walter R. Skuse and Partners Ltd., 42 Kilburn High Rd, N.W.6.

Ronson. 731,798. Class 8. Electric razors. Ronson Products Ltd., Winchester Hse, Old Broad St, E.C.2.

Baldina, 730,826. **Balda** 731,030. **Baldalux,** 731,031. Class 9. Scientific, nautical, surveying and electrical apparatus and instruments, etc. J. J. Silber, 51/54 Avenue Chambers, Vernon Place, W.C.1.

the School work is a pleasure!

Self-expression is apparently the theory in school to-day especially during the early formative years, and is seen in practice in this typical English classroom. These lucky six-year-olds at FAIRCHILDES SCHOOL enjoy all the benefits of modern education in bright, clean and cheerful surroundings. As one of the leading suppliers of electric cables for many of Britain's new schools HENLEY'S offer their wide experience and advice on problems concerning cables for every class of school installation:

HENLEY CABLES

V R TAPED AND BRAIDED CABLES
WIRING SYSTEMS FOR SURFACE OR BURYING
WHITE TRS TO BLEND WITH MODERN DECORATION
ALL MANUFACTURED TO C M A STANDARD

FAIRCHILDES SCHOOLS, New Addington *(Education Committee, County Borough of Croydon; Surrey).* Architects: Messrs. Scherrer & Hicks, F/F.R.I.B.A.
Wired exclusively with HENLEY RUBBER CABLES by
TROUGHTON & YOUNG LTD., Basil Street, Knightsbridge, London, S.W. 3

BY APPOINTMENT ELECTRIC CABLE MANUFACTURERS

W. T. HENLEY'S TELEGRAPH WORKS CO. LTD. 51-53 HATTON GARDEN, LONDON, E.C.1

Q Why Capacitors?

A *You pay less for electricity*

when the installation has a good power factor.

Induction motors, welding equipment and many other forms of electrical plant operate at a poor power factor.

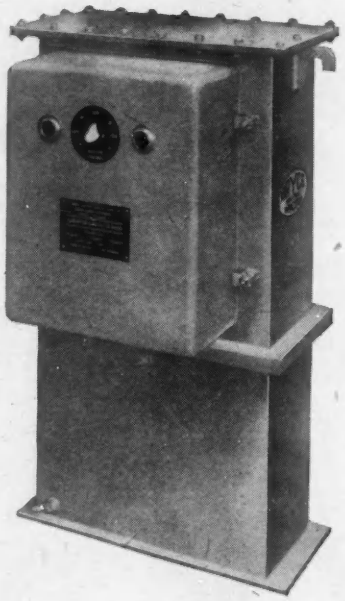
The electricity Boards take this into account when drawing up industrial tariffs and impose a penalty for low power factor.

By installing BRYCE capacitors electricity charges can be reduced and the cost of the equipment recovered in approximately 12 to 18 months.

Our engineers will undertake the necessary tests to ascertain if this saving can also be yours. This service is offered without charge or obligation.

BRYCE *CAPACITORS have the following features:—*

1. **They need negligible maintenance.**
2. **They occupy minimum floor space.**
3. **They can be supplied with individual contractor panels as illustrated.**
4. **Unit type capacitors can be supplied for individual motor correction.**



Bryce are one of the largest British manufacturers of power capacitors.

We also build all types of Power Transformers.

BRYCE ELECTRIC CONSTRUCTION COMPANY LTD.

KELVIN WORKS · HACKBRIDGE · SURREY

WALLINGTON 2601/4

Associated with HACKBRIDGE CABLE COMPANY LTD.

CLASSIFIED ADVERTISEMENTS

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 32s. 6d. per inch, and all other classified advertisements at 2s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

TENDERS INVITED

CITY OF PETERBOROUGH

THE Council invites tenders from recognised electrical contractors for the electric lighting and power installations to 48 permanent houses on the Eastfield Estate, Peterborough.

Drawings, specifications and forms of tender may be obtained on application to Mr L. H. Robjohn, M.B.E., A.M.I.C.E., A.M.I.MUN.E., Acting City Engineer and Surveyor, Town Hall, Peterborough.

Applications before noon on Saturday, 13 Nov., 1954, should be accompanied by a cheque for £2. 2s. made payable to the Peterborough City Council. This will be returned on receipt of a bona fide tender or the return of the documents.

C. PETER CLARKE,
Town Clerk.

Town Hall,
Peterborough.
Nov., 1954. (N 584)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

NORTH PERTHSHIRE DISTRIBUTION

TENDERS are invited for the construction of 11 kV and lower voltage woodpole overhead lines in the North Perthshire Area. Copies of the Tender Document may be obtained from the Engineers, Messrs Kennedy and Donkin, 3 North Charlotte St, Edinburgh 2, on receipt of a deposit of £2. 2s. (returnable).

The Board do not bind themselves to accept the lowest or any Tender.

W. D. D. FENTON,
Secretary.

16 Rothesay Terr,
Edinburgh 3. (N 583)

OXFORDSHIRE COUNTY COUNCIL

1. PROPOSED ERECTION OF SECONDARY MODERN SCHOOL, WATLINGTON
2. PROPOSED ERECTION OF SECONDARY MODERN SCHOOL, SOUTH OXFORDSHIRE (KIDMORE END)
3. PROPOSED EXTENSIONS TO WITNEY GRAMMAR SCHOOL

APPLICATIONS from Electrical Contractors desirous of tendering for the electrical installations at these schools should be sent to the County Architect, Park End St Offices, Oxford, immediately.

The Council reserve the right to select from the list of applications the firms to be invited to submit competitive tenders and do not bind themselves to accept the lowest or any tender submitted.

Specifications, schedules, lay-out and forms of tender will be issued before the end of this year.

GERALD GALE BURKITT,
Clerk of the Council.

County Hall,
Oxford.
1 Nov., 1954. (N 619)

APPOINTMENTS VACANT

Engagement of persons must be made through a Local Labour Office or Scheduled Employment Agency, if the applicant is a man aged 18–64, or a woman aged 18–59; unless the person concerned is excepted or the employment is in a managerial or professional capacity, or is otherwise excepted from the provisions of the Notification of Vacancies Order, 1952.

SOUTH EASTERN ELECTRICITY BOARD

DISTRICT ENGINEER—Central Sussex District.

Salary £858/£894 p.a. under N.J.B. Class E, Grade 3. Superannuable. Applicants should be qualified Engineers with sound knowledge of all aspects of the work of a District Distribution Department. Experience should include the planning, construction, operation and maintenance of underground and overhead systems up to 33 kV. The person appointed will be required to reside in the District and rented flat accommodation will be available.

Applications, naming 2 referees to Arthur Barnes, M.I.E.E., Central Sussex Manager, SEEBoard, Electra Hse, Church Rd, Haywards Heath, Sussex, by 17 Nov., 1954.

ASSISTANT DISTRICT COMMERCIAL ENGINEER—Eastbourne District.

Salary £555/£569 p.a. under N.J.B. Class E, Grade 10. Superannuable. Applicants should be suitably qualified and have experience in dealing with general consumer enquiries on the use and supply of electricity, including estimating for installation work.

Applications on forms from J. E. Winborne, District Manager, SEEBoard, Electric Hse, Grove Rd, Eastbourne, by 17 Nov., 1954.

A. J. BURNELL,
Secretary.
(N 606)

BRITISH ELECTRICITY AUTHORITY
Midlands Division

APPLICATIONS are invited for the following positions in the Generation (Operation) Department. N.J.B. service conditions, superannuable appointments, salaries within Schedule "A" of the Agreement.

(*a*) STATION SHIFT CONTROL ENGINEER at Nechells "A" Power Station, Grade F10, commencing at £577 per annum (Vacancy No. 802 MD).

(*b*) JUNIOR ENGINEER at Walsall Power Station, Grades G16 to 14, commencing at £402 per annum (Vacancy No. 803 MD).

Applicants for these positions should have received a sound technical training, and for (*a*) practical experience in the control and operation of steam generating plant and main switchgear. Appropriate technical qualifications an advantage.

Apply, quoting the vacancy number, on form AE6, available from the Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 20 Nov., 1954.

R. L. BATLEY,
Divisional Controller.
(N 602)

EASTERN ELECTRICITY BOARD
Northmet Sub-Area Headquarters

GENERAL ASSISTANT ENGINEER (PROGRESS)
(REF. NO. 497)
159/54.N

CANDIDATES should possess the Higher National Certificate in Electrical Engineering or equivalent qualifications and have had experience in design, construction, or operation and maintenance of H.V. and L.V. mains and substations up to 33 kV. The duties will involve the progressing of construction work on mains and substations throughout the Sub-Area, follow-up of orders for materials and preparation of routine and special reports on the progress of schemes.

Salary will be in accordance with Class N, Grade 13, of the National Joint Board Salary Agreement commencing at £692 plus London Allowance, and future salary and conditions of service will be in accordance with agreements made from time to time by the appropriate negotiating bodies.

The successful candidate will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Applications by letter stating age, education, qualifications and experience with details of present appointment and salary should be submitted to the Manager, Northmet Sub-Area, Eastern Electricity Board, Northmet House, Southgate, London, N.14, within fourteen days of the appearance of this advertisement. (N 598)

METROPOLITAN WATER BOARD

APPOINTMENT OF ASSISTANT ENGINEERS (ELECTRICAL)

THERE are vacancies for Assistant Engineers (Electrical) on the permanent pensionable staff. Salary scale £760/£30/£940 per annum. Commencing salary according to age and experience. Maximum age 45 years. It is a condition of the appointment to and the holding of the positions that the selected candidates shall be and continue to be subscribing corporate members of the Institution of Electrical Engineers. Housing accommodation may be available, if required, in a good neighbourhood, at an inclusive rent of £130 per annum. A form of application may be obtained from the undersigned on receipt of a stamped addressed foolscap envelope, quoting reference (G.P.5) and completed applications must arrive not later than 6 Dec., 1954.

W. S. CHEVALIER,
Clerk of the Board.

Offices of the Board,
New River Head,
Rosebery Ave,
London, E.C.1.

(N 565)

BRITISH ELECTRICITY AUTHORITY
North Eastern Division

APPLICATIONS are invited for the appointment of THIRD ASSISTANT ENGINEER in the Electrical Measurements Section of the Technical Department with Headquarters at Darlington.

Applicants should possess a Higher National Certificate in Electrical Engineering or equivalent qualification and have practical experience of the electrical and time measurement apparatus used in electricity generation and distribution, especially summation metering equipment. Also practical experience with all aspects of a Meter and Test Department possessing a standardising laboratory.

The salary for the appointment (which is superannuable) will be in accordance with Grade 5, Schedule "C," of the National Joint Board Agreement (£649/£835 per annum) and will commence at a point commensurate with qualifications and experience.

Forms of application may be obtained from Divisional Establishments Officer, British Electricity Authority, North Eastern Division, Carliol House, Newcastle upon Tyne 1, to whom they should be returned to arrive not later than 16 Nov., 1954.

(N 564)

BRITISH ELECTRICITY AUTHORITY
East Midlands Division

APPLICATIONS are invited for the following positions within the Division:

SHIFT CONTROL ENGINEER
LONGFORD POWER STATION, COVENTRY

Vacancy No. 161/54/ET

Applicants should have had a sound training and practical experience in a modern Generating Station. The possession of technical qualifications is desirable.

Salary will be in accordance with Class G, Grade 10 (£608/£630 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 15 Nov., 1954.

JUNIOR ENGINEERS, FREEMEN'S
MEADOW POWER STATION, LEICESTER

Vacancy No. 162/54/ET

Some experience in Control Room and Boiler House work in a large P.F. Station is required. Technical qualifications up to H.N.C.

Salary in accordance with Class H, Grade 15 (£448 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 15 Nov., 1954.

FIRST ASSISTANT STATION CHEMIST
DRAKELOW GENERATING STATION

Vacancy No. 163/54/ET

Applicants should be Associates of the Royal Institute of Chemistry or hold the Higher National Certificate in Chemistry.

Experience of Power Station practice is essential.

Salary in accordance with Class J, Grade 9 (£719/£750 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 15 Nov., 1954.

ASSISTANT MAINTENANCE ENGINEER
(MECHANICAL) DRAKELOW POWER STATION

Vacancy No. 164/54/ET

Previous operation and maintenance experience with modern high pressure plant, with technical qualifications up to H.N.C. standard essential.

Salary in accordance with Class J, Grade 9 (£719/£750 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 15 Nov., 1954.

ASSISTANT MAINTENANCE ENGINEER
(ELECTRICAL) DRAKELOW POWER STATION

Vacancy No. 165/54/ET

Previous operation and maintenance experience with all types of electrical plant in a modern Power Station, with technical qualifications up to H.N.C. standard as a minimum requirement.

Salary in accordance with Class J, Grade 9 (£719/£750 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 15 Nov., 1954.

TWO SENIOR DRAUGHTSMEN (CIVIL)
CONSTRUCTION DEPARTMENT

Vacancy No. 167/54/ET

Candidates should have experience in the preparation of detail drawings and in the design of one or more of the following subjects:

Reinforced concrete structures.

Piled and slab foundations for heavy components.

Cable subways, Bridges and Culverts.

Salary in accordance with Grade 5 (£567/£671 per annum) of Schedule D of the National Joint Board Agreement.

Closing date for receipt of applications, 15 Nov., 1954.

SHIFT CONTROL ENGINEER
NORTHAMPTON POWER STATION

Vacancy No. 170/54/ET

Applicants should have a sound technical education and experience in the operation of turbo generators and control room duties.

Salary in accordance with National Joint Board Agreement, Class G, Grade 10 (£608/£630 per annum).

Closing date for receipt of applications, 22 Nov., 1954.

GENERAL ASSISTANT ENGINEER
NOTTINGHAM TRANSMISSION SECTION

Vacancy No. 171/54/ET

Applicants should have experience of the maintenance and operation of high voltage

continued in next column

continued from previous column

overhead lines, transformer and switchgear up to 132 kV and should preferably be Graduates of the Institution of Electrical Engineers.

Salary in accordance with Class AX/DX, Grade 8 (£501/£694 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 22 Nov., 1954.

SECOND ASSISTANT ENGINEER
(ELECTRICAL) GENERATION
(CONSTRUCTION)

Vacancy No. 173/54/ET

Preference will be given to applicants who hold a degree in Electrical Engineering, are Corporate Members of the Institution of Electrical Engineers or possess other equivalent qualifications.

They should have had experience in the design and installation of switchgear, transformers and cables up to 33 kV and other electrical equipment associated with modern power stations.

Experience in the preparation of specifications and estimates and preparing reports on tenders will be a recommendation.

Salary will be within Schedule C, Class AX/DX, Grade 2 (£834/£1,053 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 22 Nov., 1954.

These appointments will be pensionable within the terms and provisions of the British Electricity Authority and Area Boards Superannuation Scheme.

Applications should be submitted on the official form A.E.6/ACT which may be obtained from the Divisional Establishments Officer, British Electricity Authority, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote Vacancy Number.

L. F. JEFFREY,
Divisional Controller.

29 Oct., 1954. (N 596)

BRITISH ELECTRICITY AUTHORITY
South East Scotland Division

HAVE vacancies for the following:

ASSISTANT SECTION ENGINEER for Edinburgh (Currie) Section. Applicants should have at least two years' experience in maintenance of 132 kV Transmission Lines, cables and substation equipment, and possess qualifications leading to Corporate Membership of the Institution of Electrical Engineers. Salary £584/£745 (N.J.B. Class AX/BX/6). Pension Scheme. No car allowance. Transport provided.

GENERAL ASSISTANT ENGINEER (TRANSMISSION) required for the Transmission Department at Portobello. Applicants should possess Higher National Certificate in Electrical Engineering, or equivalent qualification, and preferably have had some works training or experience in Construction of H.V. Substations. Salary scale £501/£656 (N.J.B. Class AX/BX/8). Placing according to experience. Pension Scheme.

Apply in writing by 20 Nov., 1954, to Divisional Controller, British Electricity Authority, South East Scotland Division, British Electricity Hse, High St, Portobello, Midlothian. (N 605)

NORTH WEST METROPOLITAN REGIONAL HOSPITAL BOARD
Regional Engineer's Department

APPLICATIONS are invited for the following post:

ASSISTANT ENGINEER (ELECTRICAL). Applicants must have passed Institution examination of the Institution of Electrical Engineers or hold exempting qualifications. Experience in general to cover lifts, wiring, mains, etc.

Salary scale: £600 by £25(7) by £30(3)—£865 plus £20—£40 London Weighting. Commencing salary above minimum subject to certain conditions.

Applications, giving age, full details of qualifications and experience, and names of two referees to Secretary, North West Metropolitan Regional Hospital Board, 11a Portland Place, W.1, by 24 Nov. (N 601)

AIR MINISTRY

require MECHANICAL and ELECTRICAL ENGINEERS in Works Department for design, operation and maintenance of mechanical and electrical services on R.A.F. stations at home and overseas and Civil Aviation stations. Appointments in two grades (*a*) Main Grade, salary scale £1,080/£1,426, (*b*) Assistant Grade, £702/£1,080. Starting pay according to qualifications and experience. Salaries somewhat lower in provinces. Candidates should be age 25 or over. Appointments temporary and non-pensionable but with long-term possibilities. Special Allowance up to £1,500 a year according to location payable in addition to salary during overseas service. Candidates must be natural-born British subjects of natural-born British parents.

Minimum qualifications and experience for both grades of posts: (i) (*a*) University degree or equivalent diploma in electrical and/or mechanical engineering and at least a two-year apprenticeship or (*b*) Graduate or Corporate Membership of the Institutions of Mechanical or Electrical Engineers with appreciable electrical engineering experience and at least three years' apprenticeship and (ii) employment in responsible position for minimum of three years with well-established engineering concern providing wide experience in electrical and mechanical engineering practice.

Application forms quoting reference D.530/54-A from M.L. and N.S., Technical and Scientific Register (K), Almack Hse, King St, London, S.W.1. (N 570)

BRITISH ELECTRICITY AUTHORITY
London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A or C. Salary includes London Allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. for post (*a*) and Corporate Membership for post (*b*) an advantage.

(*a*) ASSISTANT SHIFT CHARGE ENGINEER—
FULHAM GENERATING STATION

Vacancy No. 54/913

Sound engineering training necessary with experience of large modern Station plant. Salary—Class L, Grade 9=£851, 11s. p.a.

(*b*) FIRST ASSISTANT ENGINEER—
TECHNICAL DEPARTMENT DIVISIONAL
HEADQUARTERS

Vacancy No. 54/914

Candidates should have a wide experience of electro-technical matters including system development, testing and commissioning of electrical plant and equipment including switchgear and transformers and also protective, metering and telecommunication equipment. Successful candidate will be responsible to the Technical Engineer for administration of half of the Technical Department. Salary—Class AX/EX, Grade 1=£1,018. 10s./£1,282 p.a.

Applications, quoting vacancy number, may be made on form obtainable from Divisional Secretary, British Electricity Authority, London Division, P.O. Box 136, Generation House, Great Portland St, W.1, and be received within 14 days of this advertisement. (N 585)

DUDLEY AND STAFFORDSHIRE TECHNICAL COLLEGE

APPLICATIONS are invited for the post of ASSISTANT LECTURER in Electrical Engineering. Applicants must have had adequate industrial experience, and must be professionally qualified. Duties will begin on 1 Jan., 1955. Salary on Grade A of the Burnham Technical Report (£450 x £18—£725) with allowances where appropriate, for graduate qualifications, training and experience.

Application forms and further particulars may be obtained from the Principal, Dudley and Staffordshire Technical College, Dudley, to whom the completed forms must be returned as soon as possible.

A. W. GIBSON,
Principal.
(N 599)

YORKSHIRE ELECTRICITY BOARD

No. 4 (Leeds) Sub-Area

Leeds District

GENERAL ASSISTANT DISTRICT ENGINEER (LEEDS SOUTH)

APPLICANTS should preferably be Graduates of the Institution of Electrical Engineers and have experience in the construction, operation, maintenance and planning of overhead and underground distribution systems in densely populated industrial and residential areas.

The successful applicant must be prepared to reside within the District and undertake standby duties, if required.

Salary—N.J.B. Class J, Grade 11, £639/£665 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager No. 4 (Leeds), Sub-Area, Yorkshire Electricity Board, Bramhope, near Leeds, not later than 18 Nov., 1954.

No. 6 (Hull) Sub-Area

Bridlington District

SECOND ASSISTANT DISTRICT ENGINEER (DRIFFIELD)

Applicants should have had sound practical experience in the operation, maintenance, planning and construction of H.V. and L.V. underground and overhead lines and substations in an extensive rural area.

Preference will be given to candidates who are Corporate Members of the Institution of Electrical Engineers or possess equivalent qualifications.

The successful candidate would be required to undertake standby duty and to reside in Driffield.

Salary—N.J.B. Class D, Grade 7, £633/£643 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, Ferensway, Kingston-upon-Hull, not later than 18 Nov., 1954.

No. 1 (Bradford) Sub-Area

Keighley District

CONSUMERS ENGINEER

Applicants should be Corporate Members of the Institution of Electrical Engineers or hold qualifications leading to such membership, and must have had a sound training with subsequent experience in the work of a Consumers' Department in an Electricity Undertaking.

Details should be given of experience in the following matters:

Negotiations with consumers requiring electricity supplies, tariffs, sales development, application of I.E.E. Wiring Regulations and other relevant regulations in testing and inspecting consumers' installations, electrical installation work, including preparation of specifications and tenders, repair to electrical apparatus, control of staff and workpeople.

Salary—N.J.B. Class E, Grade 8, £619/£629 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 1 (Bradford) Sub-Area, Yorkshire Electricity Board, 45-53 Sunbridge Rd, Bradford, not later than 18 Nov., 1954.

No. 2 (Huddersfield) Sub-Area

GENERAL ASSISTANT ENGINEER (TESTING AND PROTECTION)

Applicants should be Graduate Members of the Institution of Electrical Engineers or possess equivalent qualifications and must have a sound practical knowledge of Instrument technology. Experience in the commissioning and maintenance of protective gear equipment will be an advantage.

Salary—N.J.B. Class K, Grade 13, £583/£605 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 2 (Huddersfield) Sub-Area, Yorkshire Electricity Board,

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Market St, Huddersfield, not later than 18 Nov., 1954.

No. 6 (Hull) Sub-Area

GENERAL ASSISTANT ENGINEER (METERS, TESTING AND PROTECTION)

Applicants must hold the Higher National Certificate in Electrical Engineering or possess equivalent qualifications and should have a sound practical knowledge of Meter and Instrument Technology. Some experience in the commissioning and maintenance of Protection Gear equipment will be an advantage.

Salary—N.J.B. Class K, Grade 13, £583/£605 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 6 (Hull), Sub-Area, Yorkshire Electricity Board, Ferensway, Kingston-upon-Hull, not later than 18 Nov., 1954. (N 572)

BRITISH ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following posts:

JUNIOR ENGINEER
PETERBOROUGH GENERATING STATION

Salary Class F, Grade 15, £402—Grade 14, £466 per annum.

The duties of the successful applicant will include assisting in the Control Room on shift and other operation and investigation duties.

JUNIOR ENGINEER
LUTON GENERATING STATION

Salary Class E, Grade 15, £390—Grade 14 £445 per annum.

The duties of the successful applicant will include operation of A.C. and D.C. plant on shift and technical assistance on boilers and turbines.

The commencing salary for these positions will depend upon qualifications and experience.

Preference will be given to applicants who have had previous experience in a Generating Station upon similar work and who have had technical training to Ordinary National Certificate standard or equivalent in Electrical Engineering.

Applications stating age, qualifications and experience to the Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, by 13 Nov., 1954.

W. N. C. CLINCH,
Controller.
(N 576)

BRITISH ELECTRICITY AUTHORITY

South Eastern Division

THIRD ASSISTANT ENGINEER — Brighton "B" Construction Staff. Applicants should preferably be members of a recognised professional Institution. Duties will be mainly concerned with the supervision of erection of turbines, auxiliary plant and H.P./L.P. pipework. A knowledge of power station construction and design is desirable and manufacturing works experience with site erection experience would be an advantage. N.J.B. Conditions of Service, Class AX/DX, Grade 5, £649/£790/£858 p.a. Applications, giving details of education, present position, experience, etc., should be received by Mr L. Mason, Resident Site Engineer, Brighton "B" Power Station, Portslade-by-Sea, Sussex, by 13 Nov. (N 609)

BRITISH ELECTRICITY AUTHORITY

North West, Merseyside & N. Wales Division

VACANCY No. 206/54/T—ASSISTANT SHIFT CHARGE ENGINEER, Westwood Generating Station. Salary £641/£667 (G.9).

Vacancy No. 212/54/T — STATION SHIFT CONTROL ENGINEER, Agecroft "A" Generating Station, near Manchester. Salary £577/£598 (F.10).

Applications to Controller, British Electricity House, 825 Wilmslow Rd, Manchester 20, before 13 Nov. Quote vacancy No. (N 574)

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:

SENIOR ASSISTANT ENGINEER (CONSTRUCTION), SOUTH STAFFS and NORTH WORCS SUB-AREA

Applicants should have received a sound technical training and have extensive experience in the design and construction of large distribution systems up to and including 33 kV. Experience with modern supervisory equipment is desirable. Preference will be given to candidates having appropriate qualifications, including Corporate Membership of the I.E.E. Salary £1,241/£1,280 per annum (N.J.B. Grade M.4).

Apply within 7 days stating age, experience, qualifications, present position and salary to Mr T. G. Keeler (Ref. CW), Sub-Area Manager, Midlands Electricity Board, Toll End Rd, Tipton, Staffs.

SENIOR ASSISTANT ENGINEER, WORCESTER AND DISTRICT SUB-AREA

The successful applicant will be required to carry out the installation and general maintenance of primary plant and equipment, including transformers, switchgear, protection systems, etc., associated with the 33 kV and 66 kV Systems. A working knowledge of civil engineering practice and appropriate technical qualifications will be considered an advantage. Salary £1,026/£1,071 per annum (N.J.B. Grade J.4).

Apply within 14 days stating age, experience, qualifications, present position and salary to Mr R. Mallet, Sub-Area Manager, Midlands Electricity Board, Whittington, Worcester.

JUNIOR ENGINEER, SUB-AREA METER DEPARTMENT, CENTRAL GLOUCESTERSHIRE SUB-AREA (LOCATED AT CHELTENHAM)

Duties will include laboratory work, substandard instrument calibration, the testing of polyphase metering equipment both in the Test Room and on consumers' premises, and the carrying out of special tests on other apparatus including switchgear and relays. Technical qualifications desirable. Salary £424 per annum (N.J.B. Grade H.16).

Apply, in writing, to Mr D. Holt, Sub-Area Manager, Midlands Electricity Board, 126 London Rd, Gloucester.

A. STEPHENS,
Secretary.
(N 600)

THE EAST MIDLANDS ELECTRICITY BOARD

Lincolnshire Sub-Area

APPLICATIONS are invited for the post of FEMALE DEMONSTRATOR in the Spalding District.

Applicants must have had a good education and should have a Certificate of a recognised Domestic Training College and/or the E.A.W. Certificate. Duties include Lecture Demonstrations in Service Centres and on consumers' premises and advice to consumers on the selection and use of electrical appliances. Ability to drive a motor car is essential.

Salary in accordance with Grade 1 of the National Joint Council Scale (£400/£490 per annum).

Application, in writing within 14 days, stating age, experience, qualifications and present position to Mr J. P. Tucker, Sub-Area Manager, The East Midlands Electricity Board, North House, Grantham. (N 597)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

APPLICATIONS are invited for the post of ENGINEERING DRAUGHTSMAN in North Caledonia Area at Elgin. Salary N.J.B. Schedule D.5 (at present £567/£671). Applicants should have attained National Certificate standard and have had experience in producing substation and circuit drawings and be capable of supervising the preparation of mains records. Superannuation scheme applicable.

Applications, stating age, qualifications and experience, to be forwarded to Area Manager, West Villa, Elgin, Morayshire, by 15 Nov., 1954. (N 604)

THE COUNTY COUNCIL OF THE WEST RIDING OF YORKSHIRE

Office of the County Architect

APPLICATIONS are invited for the appointment of an ELECTRICAL ENGINEERING ASSISTANT, Grade APT. IV. Salary range £580/£625.

Applicants should possess the Higher National Certificate in Electrical Engineering; have served a recognised apprenticeship with a reputable firm, and be capable draughtsmen with good experience in the preparation of schemes, specifications and estimates for all classes of electrical installation work.

The appointment is subject to the provisions of the Local Government Superannuation Act, 1937, as amended by the W.R.C.C. (General Powers) Act, 1948, and to the Conditions of Service at present in operation by the County Council. The successful candidate will be required to pass a medical examination.

Applications, on forms obtainable at this office, must be delivered not later than the first post on Monday, 15 Nov., 1954.

HUBERT BENNETT, F.R.I.B.A.,
County Architect.

Bishopgarth,
Westfield Rd,
Wakefield. (N 607)

THE NORTH WESTERN ELECTRICITY BOARD

APPOINTMENT OF SENIOR ASSISTANT, INTERNAL AUDIT SECTION, CHIEF ACCOUNTANT'S DEPARTMENT, AREA BOARD HEADQUARTERS, MANCHESTER

APPLICANTS must have had wide experience in Accountancy preferably including audit experience. Possession of appropriate professional qualifications would be an advantage.

Salary Scale: £805/£895 p.a. Grade 7, N.J.C. Conditions.

Applications to Establishment Officer, The North Western Electricity Board, Cheetwood Rd, Manchester 8, by 13 Nov., 1954.

APPOINTMENT OF SECOND ASSISTANT ENGINEER (POWER SALES) SUB-AREA CONSUMERS' ENGINEER'S DEPARTMENT, MANCHESTER

Duties will include dealing with normal industrial power enquiries and more particularly the development of the off-peak space and industrial heating loads. Corporate Membership of the Institution of Electrical Engineers or possession of the H.N.C. in Electrical Engineering will be an advantage.

Applicants must have a good grounding in building heating calculations and would be expected to be able to survey buildings or inspect architects' plans, and carry out heat loss calculations.

Salary Scale: £1,032/£1,065 p.a., Grade N.7, N.J.B. Conditions.

APPOINTMENT OF FIRST ASSISTANT COMMERCIAL ENGINEERS
(*a*) CENTRAL DISTRICT, MANCHESTER
(*b*) NORTH DISTRICT, SALFORD
(*c*) EAST DISTRICT, CHORLTON-ON-MEDLOCK

Duties will involve advising consumers on all matters normally arising from sales development, particularly in the commercial and industrial fields. Corporate Membership of the Institution of Electrical Engineers or possession of the H.N.C. in Electrical Engineering will be an advantage.

Applicants must have a comprehensive knowledge of the work of a District Sales Office, and must be qualified to relieve the D.C.E. of a considerable portion of normal routine work.

Salary Scales:

Post (*a*) Central District — £885/£923 p.a. Grade H.5.
(*b*) North District — £791/£818 p.a. Grade F.5.
(*c*) East District — £831/£867 p.a. Grade G.5.

Applications for above posts to Sub-Area Secretary, No. 1 Sub-Area, The North Western Electricity Board, Town Hall, Manchester 2, P.O. Box 493, by 13 Nov., 1954.

APPOINTMENT OF CLERK OF WORKS (GENERAL ASSISTANT ENGINEER) SUB-AREA MAINS ENGINEER'S DEPT., BOLTON

Applicants should have been building craftsmen and must have previous experience

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as either Clerk of Works or General Foreman on work comprising all trades on small and large contracts. They must be capable of setting out, checking and recording variations, controlling day-work and of submitting clear and concise reports.

Salary Scale: £616/£646 p.a. Grade L.13, N.J.B. Conditions.

Applications to the Sub-Area Manager, No. 2 Sub-Area, The North Western Electricity Board, National Buildings, St. Mary's Parsonage, Manchester 3, by 13 Nov., 1954.

APPOINTMENT OF THIRD ASSISTANT ENGINEER (SYSTEM PLANNING) SUB-AREA TECHNICAL ENGINEER'S DEPT., PRESTON

Applicants should be experienced in planning and estimating for extensions of H.V. and M.V. networks, substation design and network calculations, and should possess some knowledge of protective equipment. Preference given to holders of a degree or H.N.C. in Electrical Engineering.

Salary Scale: £766/£794 p.a. Grade L.10, N.J.B. Conditions.

Applications to Sub-Area Manager, No. 4 Sub-Area, The North Western Electricity Board, 40/41 Lune St, Preston, by 13 Nov., 1954.

APPOINTMENT OF DEMONSTRATOR—PENRITH DISTRICT

Applicants should be experienced in public demonstrations of electrical appliances, and be competent to plan and give cookery demonstrations and lectures and advice to consumers on the utilisation of electrical appliances. They should have had a Domestic Science training and preferably hold the E.A.W. Electrical Housecraft Certificate.

Salary Scale: £400/£490 p.a. (progress beyond £440 subject to certificate of capability). Grade 1, N.J.C. Conditions.

APPOINTMENT OF GENERAL ASSISTANT DISTRICT COMMERCIAL ENGINEER, PENRITH DISTRICT

The successful applicant will be required to assist in the preparation of estimates and in the supervision of Contract work for Commercial, Industrial and Street Lighting schemes. Experience in agricultural applications of electricity would be an advantage. H.N.C. standard of education is desirable.

Salary Scale: £433/£442 p.a. Grade D.13, N.J.B. Conditions.

Applications for the above posts to Sub-Area Manager, No. 6 Sub-Area, The North Western Electricity Board, Castle Green, Kendal, by 13 Nov., 1954. (N 573)

SOUTHERN ELECTRICITY BOARD

Senior Draughtsman (Civil Engineering)

NO. 1 (Southall) Sub-Area, Waterloo Rd, Uxbridge. Salary N.J.B. Schedule "D," Grade 5 (£595. 7s./£704. 11s. per annum, inclusive of London Allowance). N.J.B. Conditions of Service.

Applicants should have had training and experience in building construction and the design of steelwork and reinforced concrete structures, and be capable of preparing drawings, and making calculations.

The successful candidate will be required to contribute to the B.E.A. and Area Boards' Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, 2/6 Windmill Lane, Southall, Middlesex, and returned to him in envelopes suitably endorsed not later than 19 Nov., 1954. (N 608)

BRITISH ELECTRICITY AUTHORITY

South Western Division

GENERAL ASSISTANT ENGINEER required in the Technical Department (System Planning and Development Section). Superannuation Scheme. Salary, N.J.B. Class AX/CX Grade 6, £584/£765.

Applicants should possess qualifications leading to A.M.I.E.E., and should be experienced in system calculations, use of d.c. calculators and in protective gear co-ordination.

Applications on Form A.E.6/ACT, obtainable from the Divisional Secretary, 26 Oakfield Rd, Bristol 8, should be completed and returned by 15 Nov., 1954. (N 603)

ELECTRICAL DRAUGHTSMAN

required for the Public Works Department, UGANDA, for one tour of 30-36 months with prospect of renewal of contract. Salary scale (including present temporary allowance of 35% of salary) £742 rising to £1,215 a year. Commencing salary according to age and war service. Provident Fund. Outfit allowance £30. Free passages. Liberal leave on full salary. Candidates age 30 to 40 must have had at lesat 5 years' responsible experience as an electrical draughtsman with a large contracting or manufacturing organisation and should preferably have had experience in co-ordinating the layout of electrical services and different types of wiring installations taking into account Builders' and Architects' requirements and special design features. Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2A/40510/EE. (N 575)

MINISTRY OF FUEL AND POWER

MINES INSPECTORATE

THE Civil Service Commissioners invite applications from men for a pensionable post in London of H.M. Deputy Principal Electrical Inspector of Mines and Quarries. Age at least 35 on 1 Nov., 1954.

Candidates must be Corporate Members of the Institution of Electrical Engineers: the possession of a degree in Electrical Engineering in addition would be an advantage. All candidates must have had, within the last five years, at least two years' practical experience in the application of electricity to mining.

Salary Scale (London) £1,650/£1,950. Promotion prospects.

Further particulars and application forms from the Civil Service Commission, Scientific Branch, 30 Old Burlington St, London, W.1, quoting No. S4386/54. Completed applications must be returned by 13 Dec., 1954. 3371/110/10/54/FW. (N 569)

SENIOR SALES APPOINTMENT

BRUSH ELECTRICAL ENGINEERING CO. have several vacancies for SENIOR SALES ENGINEERS to reinforce the Sales Division, due to expansion. These appointments call for responsible senior men capable of working on their own initiative and there are excellent opportunities for promotion to higher executive posts. Applicants should preferably be corporate members of the I.E.E. but candidates without this qualification but with suitable experience in Sales Engineering will also be considered. There are attractive conditions of employment including staff bonus and non-contributory superannuation. Replies to Personnel Officer, Brush Electrical Engineering Co., Ltd., Loughborough, Leicester. (N 620)

BRITISH ELECTRICITY AUTHORITY

South Wales Division

Vacancy No. 108/54.

APPLICATIONS invited for superannuable N.J.B. appointments in the Divisional Drawing Office, Construction Department.

SENIOR DRAUGHTSMAN (Electrical), Salary Schedule D, Grade 5, £567/£671.

ENGINEERING DRAUGHTSMAN (Electrical), Schedule D, Grade 6, £433/£567.

Candidates should be suitably qualified and have had experience in the preparation of layouts and diagrams for the installation of power station auxiliaries, E.H.T. and L.T. switchgear, transformers and cables. Knowledge of protective gear systems advantageous.

Application forms obtainable from Secretary, South Wales Division, British Electricity Authority, Twyn-y-Fedwen Rd, Gabalfa, Cardiff, should be returned by 19 Nov., 1954. (N 610)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2.

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments, which are superannuable and subject to medical examination, in the Board's No. 2 Sub-Area:

GENERAL ASSISTANT ENGINEER (PLANNING) in the No. 2 Sub-Area Headquarters, Sandiway House, near Northwich, Cheshire. Salary £583/£605 per annum (N.J.B. Class K, Grade 13). Applicants should be Chartered Electrical Engineers, or possess the technical qualifications to enable them to become Chartered Electrical Engineers, and also have had experience in overhead and underground distribution work.

ASSISTANT SECTION ENGINEER in the Runcorn District. Salary £587/£600 per annum (N.J.B. Class E, Grade 9). Applicants should have had experience in H.T. and L.T. overhead and underground distribution work, and preferably have the technical qualifications to enable them to become Chartered Electrical Engineers.

INSTALLATION INSPECTION ENGINEER in the Warrington District. Salary £577/£598 per annum (N.J.B. Class F, Grade 10). Applicants should possess the qualifications necessary to enable them to become Chartered Electrical Engineers. Previous experience in installation work advantageous.

Application forms for all posts are obtainable from the Manager, No. 2 Sub-Area, Sandiway House, near Northwich, Cheshire. Closing date: 15 Nov., 1954. (N 557)

A LEADING cable manufacturer in North London has a vacancy in the Test and Research Department for a JUNIOR DRAUGHTSMAN. The work involves the design and development of accesscries for use with high voltage cables. A knowledge of electrical engineering would be an advantage. Previous experience not essential. Applicant should have completed his National Service. Salary in accordance with A.E.S.D.—Box No. 3969, Electrical Times. (N 561)

AGENT required by well-known Domestic Appliance Manufacturers to cover the areas of Northumberland and Durham. Wide experience of the Wholesale trade, Electricity Boards and Local Authorities essential. Remuneration by Nominal Retainer and Commission. Must be car owner. Position offers vast scope to successful applicant. Present Staff notified.—Box No. 3985, Electrical Times. (N 593)

BRANCH MANAGER required for electrical contracting business in Surrey. Must be able to organise showroom sales and handle contracting. Apply stating age, experience and salary required to—Box No. 3979, Electrical Times. (N 590)

DESIGN ENGINEERS of degree standard with works training are required by rapidly expanding instrument company. Applicants must have had experience in the design of electro-mechanical devices, etc. The position offers excellent prospects to young men who are seeking a permanent position with an expanding team engaged on interesting new instrument problems. Houses are available for successful applicants. Write—Box No. 3957, Electrical Times. (N 518)

CHIEF ENGINEER

required to commence duty as early as possible and to control Drawing Office, Development and Design. Must have technical and practical experience of Switchgear up to 11 kV and preferably some knowledge of Motor Control Gear. He must be a Member or Associate Member of the Institution of Electrical Engineers. Good permanent and progressive position with high salary for the right man. Pension scheme in operation. Apply by letter, marked personal, giving full particulars of experience, salary required, to Managing Director, Erskine, Heap and Co., Ltd., Lancashire Switchgear Works, Manchester 7. (N 505p)

DEMONSTRATOR required, to assist in the electrical section, the Building Centre, London, W.C.1. Salary in accordance with N.J.C. scale, Grade 1. Write, giving age and full details of education and experience to Director, E.D.A., 2 Savoy Hill, W.C.2. (N 567)

DESIGNERS required for A.C. Motors and Generators, medium and large. Applicants must have a degree or Higher National Certificate in Electrical Engineering. Practical experience essential. Write, giving details to the Staff Manager, General Electric Co., Ltd., Witton, Birmingham 6. (N 611)

DESIGN DRAUGHTSMAN. An excellent opportunity occurs with Housing assistance available for a first class Designer Draughtsman, with experience of Light/Medium Electro-Mechanical equipment for development work on battery electric trucks of advanced design. A substantial salary is offered to a man of proved ability. Applicants should be of H.N.C. standard, must have an original outlook and be capable of taking charge of a job from its conception to the production stage. Modern factory in country district, 1 hour London. Reply in confidence giving all details to—Box No. 3967, Electrical Times. (N 560)

DESIGNER-DRAUGHTSMAN for small accessories, state electrical qualifications and experience, to Wandsworth Electrical Manufacturing Co., Ltd., Sheerwater, Woking, Surrey. (N 614)

DRAUGHTSMAN with experience of Electro-Mechanical Instrumentation required immediately for interesting work in connection with Government and Commercial requirements in new and pleasant Drawing Office. National Certificate an advantage but not essential. Excellent conditions. 5-day week. Apply to General Manager, Hendrey Relays Limited, 392 Bath Rd, Slough, Bucks. (N 594)

DRAUGHTSMEN with sound experience in the design of High Voltage Isolating Switches and Fuses 11,000 V and above. Very good prospects for fully-trained draughtsmen. Write giving particulars of experience, age and salary required to—Box No. 3935, Electrical Times. (N 489)

ELECTRIC CABLE MANUFACTURER (C.M.A.) requires SALES ENGINEER to cover W. and N.W. London districts. Send full particulars of past experience, whether car owner and salary required, to—Box No. 3965, Electrical Times. (N 559)

ENGINEERS possessing a Degree or Higher National Certificate in Electrical Engineering are invited to apply for vacancies in connection with Design, Application and Commissioning of Protective Gear on electrical power systems. Previous experience in this class of work is desirable but young men having the necessary technical qualifications may be accepted for training. Apply with full particulars to the Chief Engineer, A. Reyrolle and Company Ltd., Hebburn, Co. Durham. (N 579)

ENGINEER, aged 25 to 35, preferably having Higher National Certificate, required for the maintenance of electronic equipment and the testing and alignment of new instruments used for quality control and automatic testing of all types of telecommunication cables. Apply giving full particulars to—Box No. 3951, Electrical Times. (N 502)

ELECTRICAL ENGINEER required by well-known electrical organisation to manage new offices to be opened shortly in the City of London. Applicant should be Chartered Electrical Engineer or have University Degree, be capable of handling staff and meeting customers of Executive standard. Suitable training with well-known firm essential. Generous Superannuation Scheme in operation. Good commencing salary and excellent opportunities of promotion. Apply, in writing, stating age, qualifications and training to—Box No. 3975, Electrical Times. (N 588)

THE BRITISH THOMSON-HOUSTON COMPANY LIMITED

has vacancies on its design and development staffs at Rugby, Birmingham, Coventry, Leicester, and Newcastle-under-Lyme, for ELECTRICAL and MECHANICAL ENGINEERS with experience in the following fields:

INDUSTRIAL ELECTRONICS (all modern applications of electronics).

ELECTRICAL MACHINE DESIGN (A.C. and D.C., large, intermediate and fractional h.p. sizes).

INDUSTRIAL APPLICATION OF ELECTRICAL EQUIPMENT (steel works, mining, paper mills, machine tools and other industries).

TRANSFORMER DESIGN (large E.H.T., intermediate and small).

AIRCRAFT ELECTRICAL EQUIPMENT (A.C. and D.C. generators, motors, contactors, starters, etc.).

The openings provide good prospects for young men with technical ability and education in a large rapidly growing industry with ample opportunities for gaining experience in new fields. Young men with honours engineering or science degrees or their equivalents, and engineers with practical mechanical design experience on the drawing board, are required. Applications should be made to the Chief Electrical Engineer's department, the British Thomson-Houston Co., Ltd., Rugby, together with particulars of technical qualifications, training and experience. (N 563p)

ELECTRICAL CONTRACTORS, London, require MANAGER. Experience in estimating and control of contracts essential. Must be capable of meeting and handling customers and consulting engineers. Excellent opportunities of promotion for one with ambition. Generous superannuation scheme. Apply, in writing, stating age, apprenticeship and experience to—Box No. 3977, Electrical Times. (N 589)

ELECTRICAL ENGINEER—25/30 years of age, as assistant to Chief Engineer. Applicants should have H.N.C. and knowledge of E.H.T. Switch Gear. Some practical experience in industry an advantage. Applications with full particulars of experience, etc., to British Acheson Electrodes Ltd., Wincobank, Sheffield. (N 578)

ELECTRICAL FITTER, maintenance H.V. switchgear, transformers, East and North East London. Works apprenticeship and experience desirable. Wages, conditions, N.J.I.C. Agreement. Apply Transmission Engineer, British Electricity Authority, London Division, P.O. Box 136, Generation House, Great Portland St, W.1.

JOINTER required by LONDON ELECTRICITY BOARD in O. and M. Branch of the Stepney/Bethnal Green District, Northern Sub-Area. N.J.I.C. rates and conditions. 3s. 11d. p.h. 44-hr 5-day week. Application forms from Personnel Officer, 46 New Broad St, E.C.2. Please enclose addressed envelope and quote ref.: M/3363/T. (N 616)

SIMPLEX ELECTRIC CO., LTD.,

require an experienced REPRESENTATIVE for the North East Midlands. Must be fully conversant with modern installation practice and able to develop the sale of the Company's products in this field. Preference will be given to an applicant who is a car owner and is resident in the Derby/Nottingham district. Applications stating age, qualifications and salary required should be made to the

Secretary,
SIMPLEX ELECTRIC CO., LTD.,
Oldbury, Birmingham.
(N 613p)

FERRANTI LTD.
TRANSFORMER DEPARTMENT

have vacancies in their Research and Development Sections for:

(1) SENIOR ENGINEERS with First or Second Class Honours Degrees in Electrical Engineering and with previous experience of research and development work in Power Engineering. The work would be concerned with transformers, voltage regulators, and specialised high voltage equipment. Ref. T.S.E.

(2) JUNIOR ENGINEERS of approximately H.N.C. standard for work in the same fields. Ref. T.J.E.

Permanent staff appointments with pension benefits.

Application forms from:

Mr T. J. Lunt, Staff Manager, Ferranti Ltd., Hollinwood, Lancs.

Please quote appropriate reference. (N 568p)

JOINTERS and ELECTRICIANS and MATES required London Power Station Contract including Saturday and Sunday working. (WAT 5891.) (N 487)

LIGHTING ENGINEERS required for London Office of Ekco-Ensign Electric Ltd. Applicants must be well educated and conversant with modern practice. Apply Senior Lighting Engineer, 45 Essex St, Strand, W.C.2. (N 618)

MAINTENANCE ELECTRICIANS required for shift work and day work in large Paper Mill. Sound experience o' large A.C. and D.C. motors and switchgear essential. Bowater's Thames Paper Mills Limited, Northfleet, Gravesend, Kent. (N 617)

PROGRESSIVE Electrical Wholesalers require the services of an experienced ORDER CLERK. Male or female. Apply: Electrowares Ltd., 302 Waterloo Rd, S.E.1. Telephone: WATerloo 5271. (N 586)

PROCESS CONTROL ASSISTANT, age 22/35, required to supervise all stages of manufacture of paper insulated cables. Minimum qualifications of ordinary National Certificate. Experience with the cable industry desirable but not essential. Good salary, pension fund. Excellent prospects for the right man.

Apply to the Secretary, W. T. Glover and Co., Ltd., Trafford Park, Manchester 17. (N 577)

PUBLICITY MANAGER required for old-established Engineering Company in London. Experience in the Lighting Industry would be an advantage. Pension scheme in force. State age, experience and salary required.—Box No. 3959, Electrical Times. (N 519)

QUALIFIED ELECTRICAL ENGINEER required for Hydro-Electric Power undertaking in Northern Nigeria, 4,000 ft above sea level, pleasant climate. Comfortable furnished quarters provided, first class passages for self, wife and two children or equivalent benefits if children remain at home. Good salary and pension scheme with liberal leave after 18 months' tour. Apply stating age, full qualifications and experience to Box No. 1053, The E.C. Advertising Co., 54 Old Broad St, E.C.2. (N 515)

Draughtsmen

required for Automatic Electric Control Gear; 5-day week; excellent working conditions; Canteen facilities; convenient transport; Incentive Bonus; Superannuation Scheme; salary according to qualifications, ability and experience. Apply Asst. Sec.: Watford Electric and Mfg. Co., Ltd., Watford, Herts. (N 385p)

QUALIFIED ELECTRICAL ENGINEER required for position of Chief Electrical Engineer with company situated in London manufacturing electrical switches and control gear. Age between 30-40 and applicants must hold electrical degree. Write stating age, qualifications, experience and salary required.—Box 3981, Electrical Times. (N 591)

REPRESENTATIVE Lancashire / Yorkshire, required by leading firm producing Appliance Switches and Motor Control Gear. Excellent opening for man with good connections amongst manufacturer. Will be required to join staff and should possess car. Write, giving full particulars and remuneration expected, to—Box No. 3973, Electrical Times. (N 571)

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TECHNICAL ASSISTANT required for testing and investigation of Domestic and Industrial Appliances prototypes. Higher National Certificate standard essential.

Reply giving full details of experience, age and salary required, to: The Chief Technical Engineer, Revo Electric Co., Ltd., Tipton. (N 580)

TECHNICAL REPRESENTATIVE, expd. over 25 yrs. B.SC.ENG. or equiv. required by London mfrs. of electrical industrial heating apparatus. Write in strictest confidence stating education, career to date and present salary to—Box 3983, Electrical Times. (N 592)

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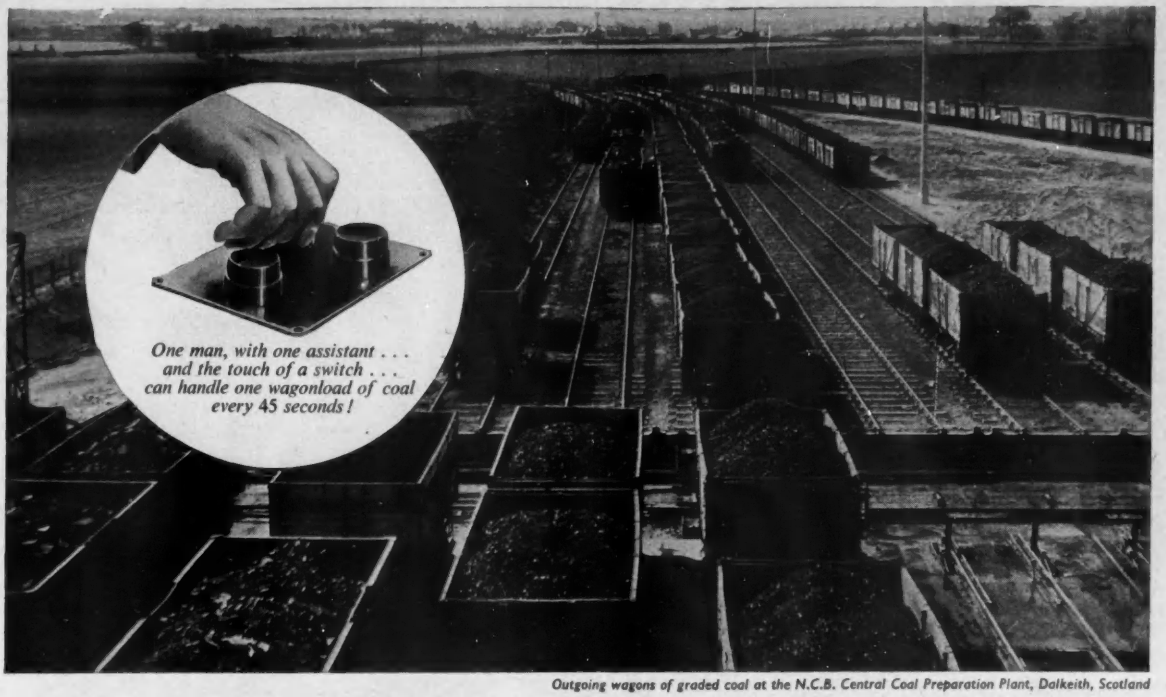


Outgoing wagons of graded coal at the N.C.B. Central Coal Preparation Plant, Dalkeith, Scotland

NEW APPROACH TO WAGON HANDLING

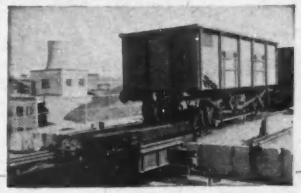
. . . Mitchell system means smaller sidings, quicker turnround, less gear, greater safety

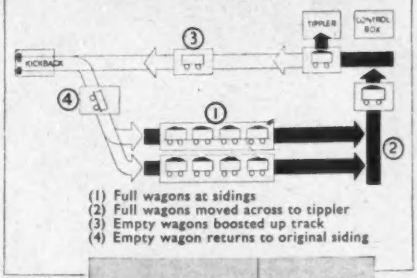
How many men work on your coal sidings? How many locomotives or capstans? What space is wasted by sprawling tracks? How much tonnage can you handle per hour?

The generally unsatisfactory answers given to such questions as these inspired the design of the Mitchell system of wagon handling—a mechanical, electrically-controlled system that offers remarkable scope for increased efficiency at power stations, collieries, coal preparation plants, steelworks, etc., and other centres of industry possessing marshalling yards.

The Mitchell system can be operated by two men. It takes wagons from the arrival sidings, loads or unloads them, weighs them and remarshals ready for departure. Wagons can be emptied and returned to the same siding they arrived at "full" so that one track is used for full and empty wagons. No internal shunting, no additional motive units, no man-handling other than initial uncoupling and final recoupling, are required. The system has no limit to size or capacity and can easily handle the 1000 tons or more of coal per hour which is now being called for. And it does it with the highest degree of safety, in all weathers, round the clock if needs be.

By demanding no more than half the space occupied by traditional balloon sidings, the Mitchell system makes possible the erection of new plant on sites hitherto unsuitable, with very large savings in initial and later costs. Its flexibility makes it adaptable to any individual handling problem. Installations are already at work for the National Coal Board and the British Electricity Authority. The thoroughgoing efficiency and economy of the Mitchell system puts it far in advance of any traditional method and establishes it as the system of the future.





(1) Full wagons at sidings
(2) Full wagons moved across to tippler
(3) Empty wagons boosted up track
(4) Empty wagon returns to original siding

An installation at the British Electricity Authority, Freemens Meadows, Leicester, handling 800 tons of coal an hour. The site is limited in area and normal methods of working with balloon sidings would be impractical. The pictures show the traverser pulling an incoming truck on to the transfer rail and an emptied wagon being returned to the siding by the 'kickback'.

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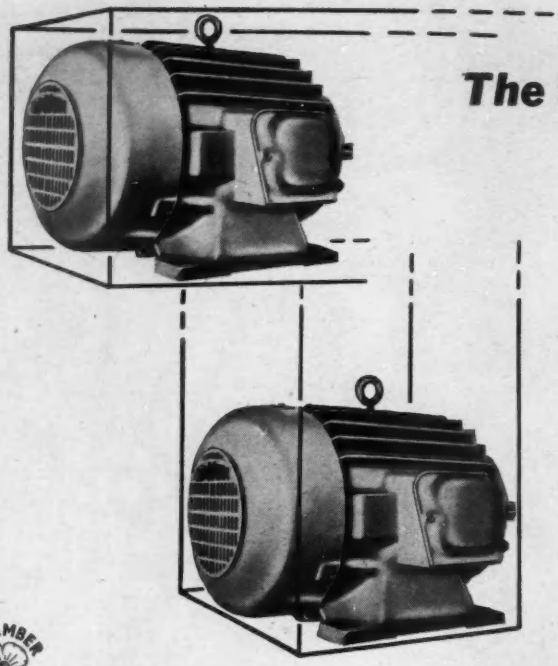

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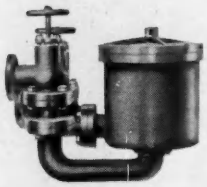

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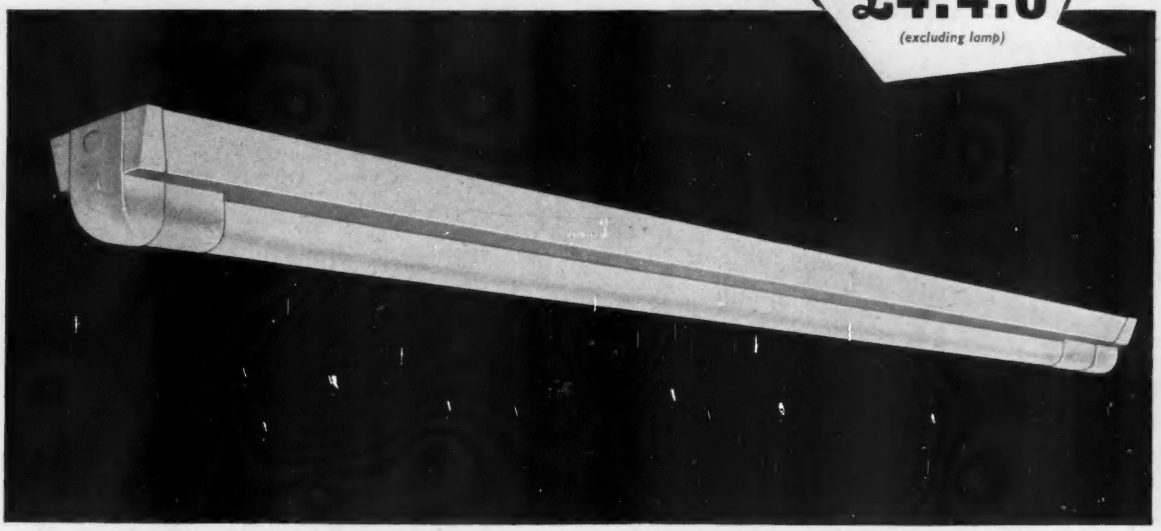

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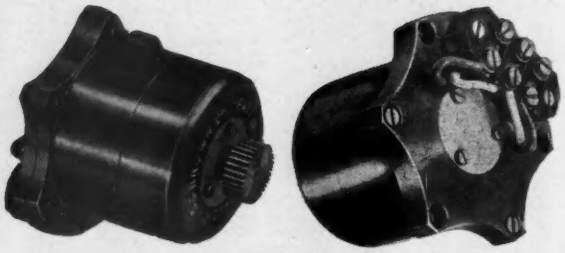

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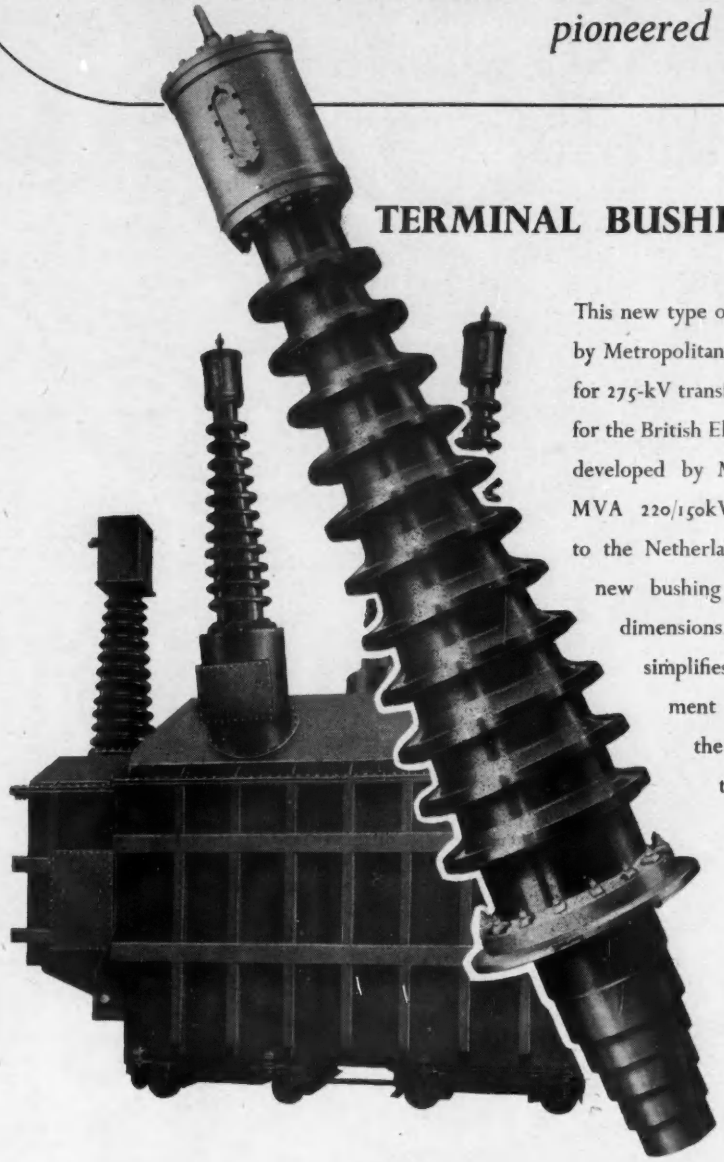

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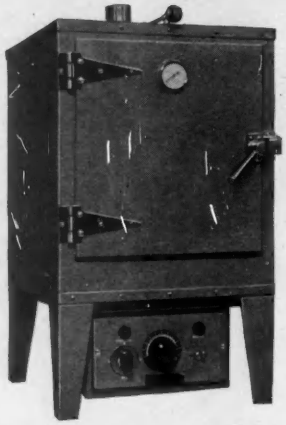

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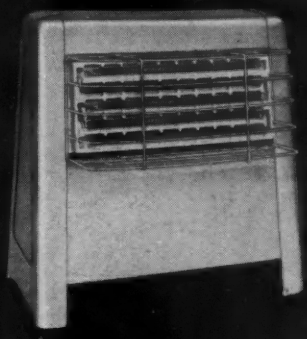

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Bronze, Cream or Green finish. Height 10½ in., width 11 in., depth 4½ in.

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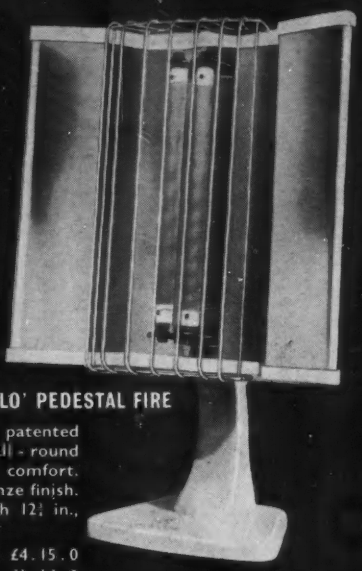

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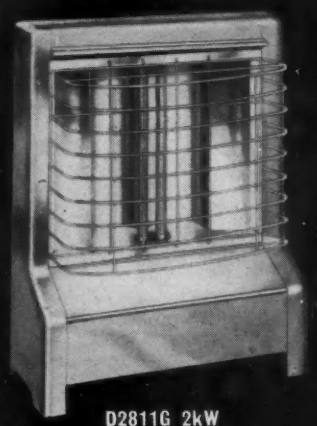

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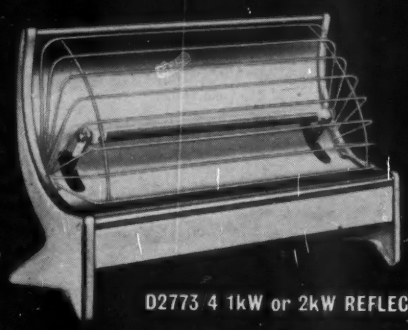

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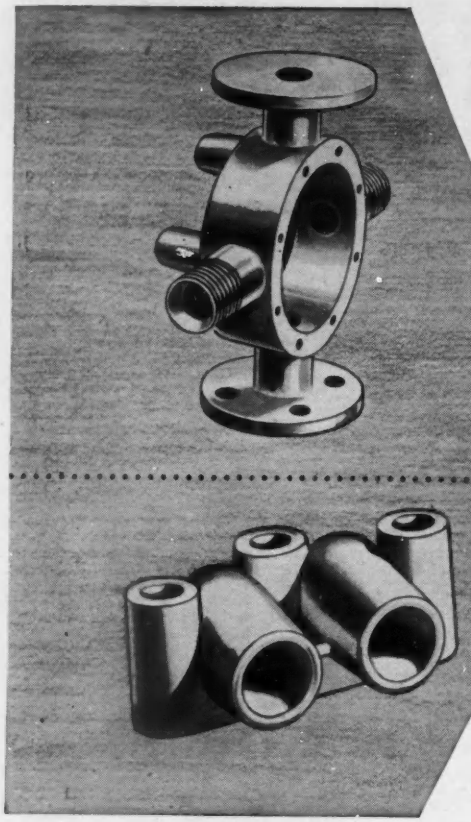

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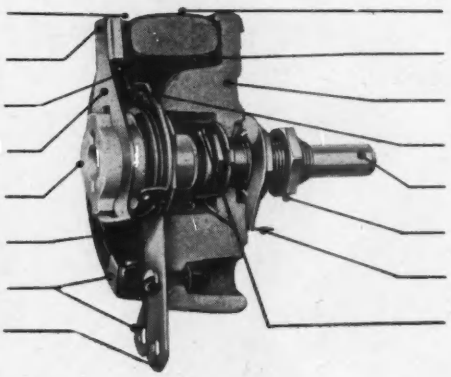

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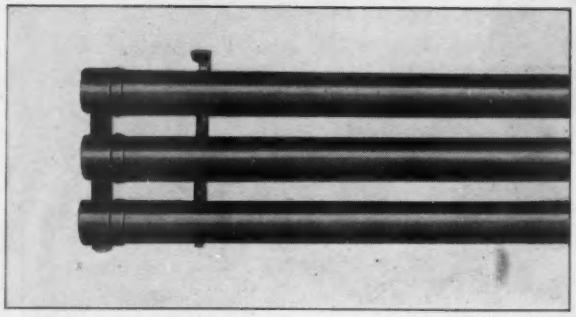

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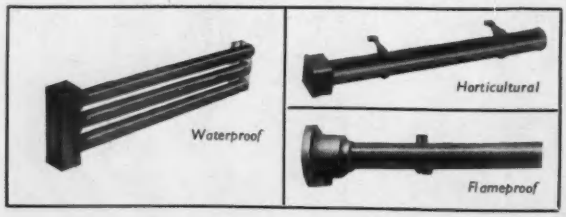

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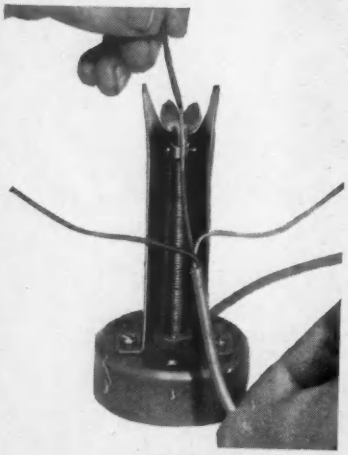

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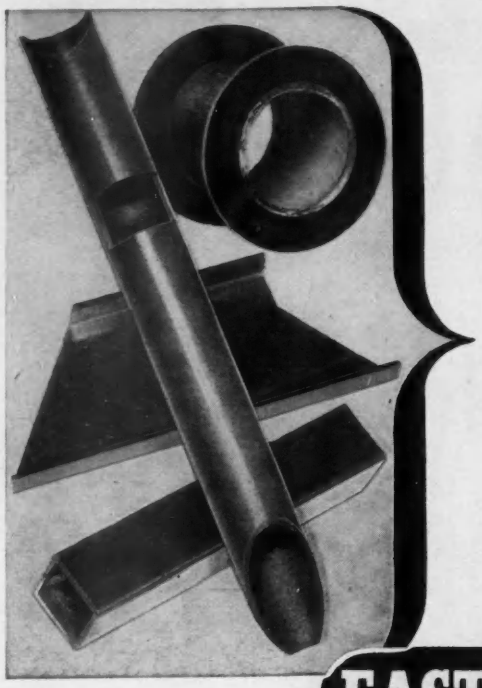

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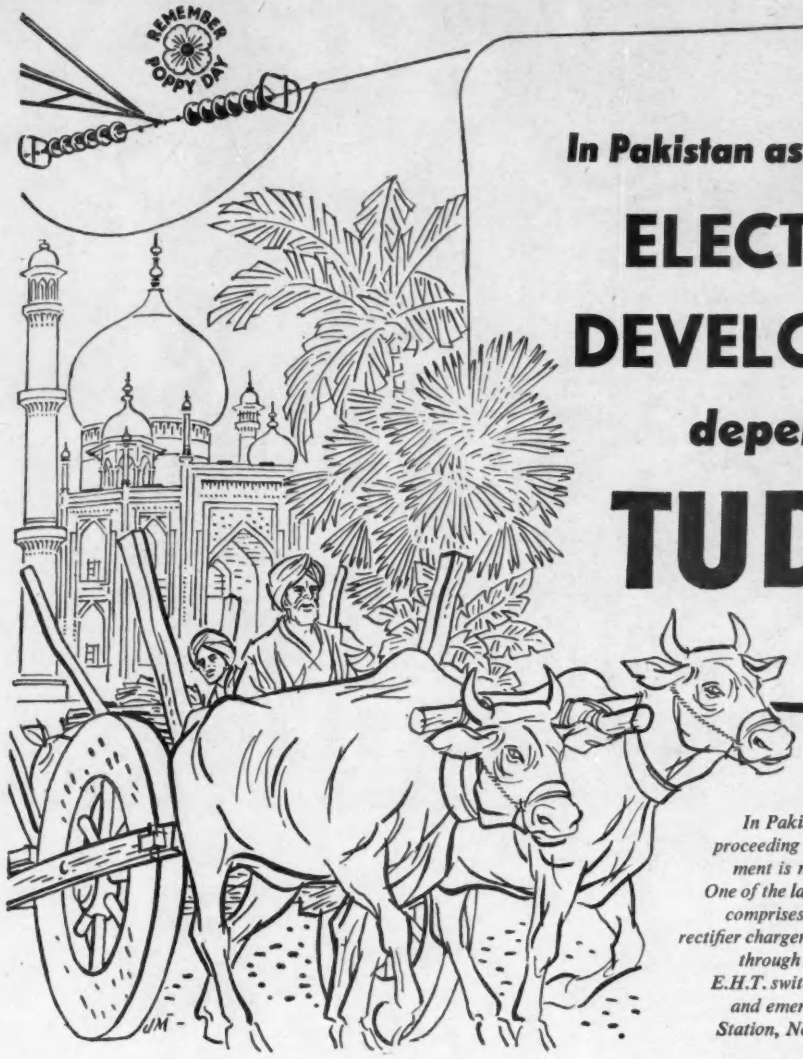

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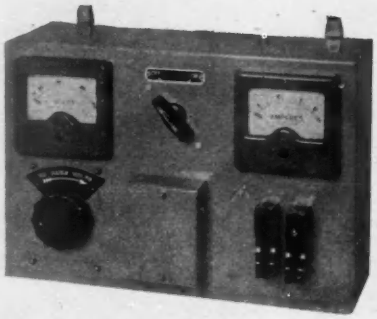

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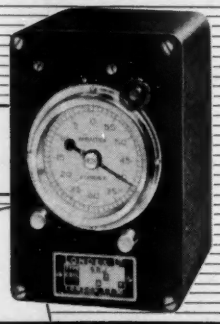

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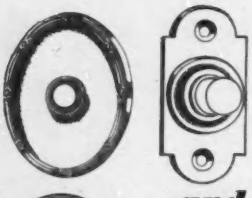

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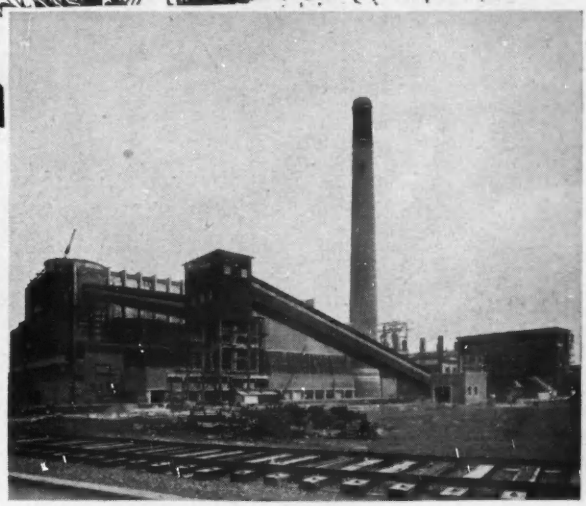

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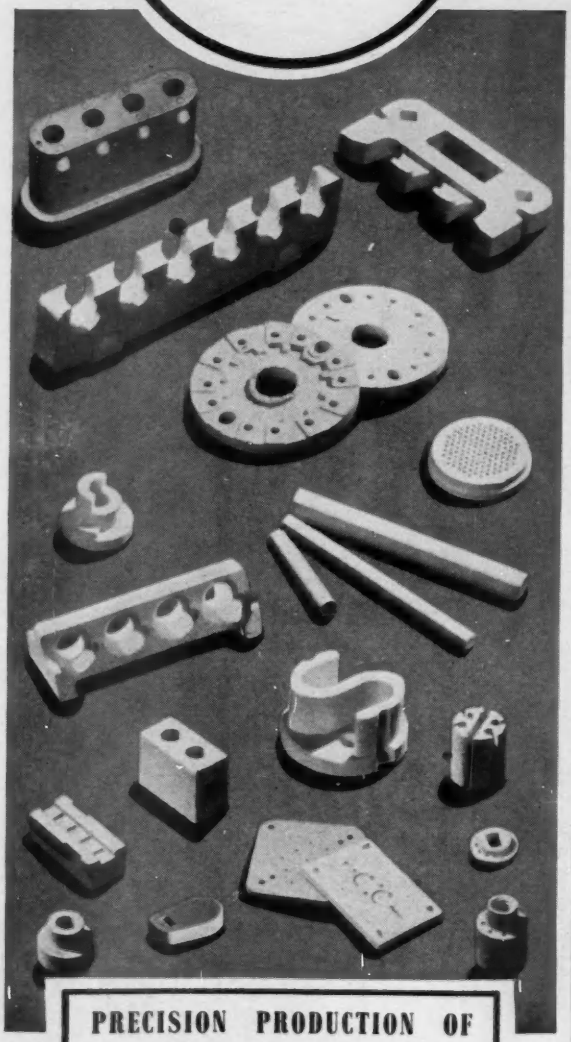

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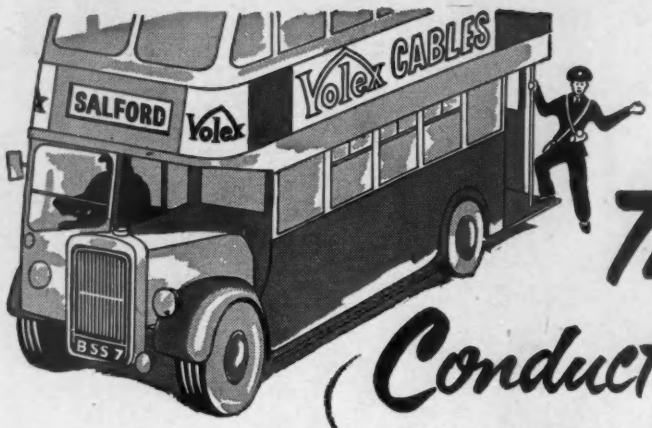

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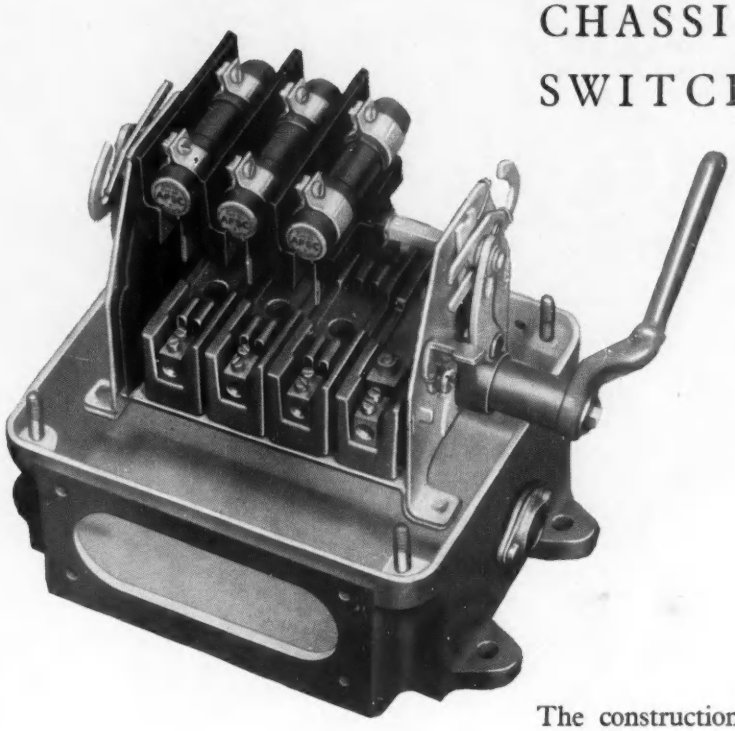

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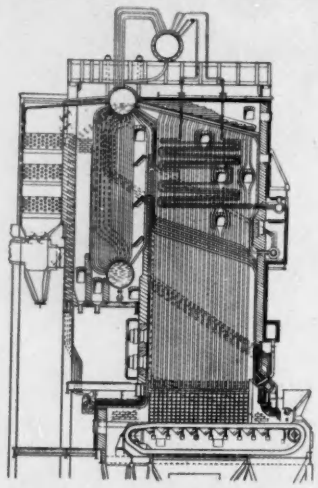
STEAM GENERATION-



Typical arrangement of a John Thompson 'Radiant Heat' Water Tube Boiler, as used in Power Stations and Industrial Installations

The Water Tube Boiler

The modern Water Tube Boiler is a large steam generating unit providing immense quantities of steam at high pressure and high temperatures as power for the turbo-electric machines in Power Stations. The design and construction of a complete Water Tube Boiler installation requires much engineering skill to put together the multitude of component parts. Below is a portion of our Drawing Office where we build the entire job on paper to ensure accurate interlocking of hundreds of different parts, which include many actual miles of steel tubes and hundreds of tons of steel in various forms.

Please address enquiries, and requests for illustrated literature to:—

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